Engineering Investigation of Information Integration Display (IID) Integration with Platform Systems

Final Report

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PWGSC Contract Number: W7707-135621/A
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Contract Report
DRDC-RDDC-2014-C226
July 2014

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Abstract

This project investigated the feasibility and level of effort in acquiring the data required by the Information Integration Display (IID) system from current and near-future submarine systems. An IID Information Matrix is presented that describes 183 unique information types needed by the IID. For each of these, we identify potential submarine system source(s), recommend method(s) to make this information available to the IID, and list properties, both as needed by the IID and as available from the source. Recommendations for providing information to the IID include: i) developing an interface to CCS 876 Unicast data, ii) developing remote devices at four key locations, networked to the IID, to facilitate manual data collection and planning activities and provide the only feasible source of such data for the IID, iii) separate downloading of systems' "a priori" data (e.g., charts from SHINNADS Dual Monitor (SDM)) to the IID, iv) maintaining history data in the IID, and v) manual data entry into IID where appropriate. Based on the completed IID Information Matrix, we identify several issues and suggest appropriate solutions. Finally, we describe any outstanding issues and recommend the way ahead.

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1 Project Goals

1.1 Objectives

Defence Research and Development Canada (DRDC) Atlantic has conducted a Cognitive Work Analysis (CWA) for key Victoria Class Submarine (VCS) Control Room personnel, leading to the design of the Information Integration Display (IID) to bring relevant data together onto a single screen that is formatted to support Command decisions.

This project will investigate the feasibility, likely level of effort required and constraints of acquiring the data required by the IID system from the submarine information systems. The aim of this contract is to determine the scale of the integration work required to connect the developed IID display to current and near-future submarine information systems, primarily the Submarine Command and Control System (CCS 876), but secondarily the Central Surveillance System (CSS), Autopilot, Bathymetric Sampling System (BSS), and other systems as appropriate, to provide the required data to the display system.

Where required inputs are not readily available or are available from relevant sources, recommendations on the scope and feasibility of work required to obtain data will be determined.

1.2 Scope

The scope of this study is constrained by the following assumptions:

1. The information requirements of the IID are as identified in the Government Furnished Information (GFI) provided to Lockheed Martin Canada (LMC) by DRDC Atlantic, primarily references [1], [2] and [3].

2. In conjunction with the project Scientific Authority, it was decided to limit consideration of future information systems to systems already out for contract. As for soon to be obsolete systems, like the legacy Autopilot and legacy Surveillance System, LMC emphasized instead their planned replacements, the next generation Autopilot and CSS, respectively.

3. In determining the systems from which the required IID information is available, if multiple options exist, preference will likely be given to systems not yet implemented, where there may be the greatest likelihood of influencing system design to accommodate necessary changes to support the IID.

4. Throughout the report, we refer to SHINNADS Dual Monitor (SDM). Unless specified otherwise, we are not making any distinction between it and related system names like “SHINNADS” and “Electronic Chart Precision Integrated Navigation System (ECPINS)”.

2 Methodology

In order to fulfil the project objectives, the project investigations were conducted in the following primary tasks:

1. Task 1 – Identify the information types needed for the IID.

2. Task 2 – Investigate potential sources for the information types, and specify the properties of the information types both as used by the IID and as produced by the sources.

3. Task 3 – Based on the findings of the first two tasks, identify problems and recommend potential solutions.

The results of Tasks 1 and 2 were recorded in the “IID Information Matrix” described in more detail in Section 3.1.

The specific methodology used for each of these tasks is described in the following sub-sections.

2.1 Task 1 – Identify the Information Types Needed for IID

As a starting point for defining information types needed by the IID, we listed in the IID Information Matrix (see Section 3.1) all the “Information Requirement” items from the IID Area description tables in the IID Design Document (reference [1]).

These items were revised to provide more accurate definitions and descriptions. New items alluded to or implicit in the Design Document, which had been omitted from the IID Area description tables, were added.

The “Virtual Victoria Data Model” (reference [2]), “Assumptions and Specifications Matrix” (reference [3]), and a DRDC Atlantic demonstration to LMC of the prototype IID were used to augment and revise the list of information types.

Finally, the complete list of information types composed from the preceding steps included many redundant items. These were identified as such to create a list of unique information types. In the IID Information Matrix, each of the unique information types were numbered consecutively in the order listed; redundant information types were shaded blue and left unnumbered.

2.2 Task 2 – Investigate Sources and Properties of the Information Types Needed for IID

To the extent possible from the IID documentation made available to LMC (references [1], [2] and [3]), the properties of the information types as needed by the IID were entered in the IID Information Matrix. These properties included units, resolution, and allowed staleness. Originally, it had been planned to include “accuracy” of the information as required by the IID as one of the properties to consider. However, the IID design documents made available for this

study did not provide sufficient insight into this property to make it worth including in the IID Information Matrix. Furthermore, although "allowed staleness" was included in the IID Information Matrix, there was not much information on this property either in the IID design documents provided.

LMC identified potential source(s) of the various information types specified in the IID Information Matrix, determined if and how this information could be made available to the IID, and in the case of multiple sources for an information type, suggested the prioritization (Low, Medium, High) of the sources to utilize.

Finally, we populated the various fields in the IID Information Matrix regarding the properties of the information types as available from the source. The properties used are described in more detail in Section 3.1. Originally, it had been planned to include "accuracy" of the information produced by the source as one of the properties, but this was omitted because: i) there is often little or no information available on the accuracy of the source; ii) when information is available, it often tends to be Classified, whereas it was intended to keep the report Unclassified, and iii) some information types involve multiple systems (e.g., contact bearing, which could come from bow sonar, flank/towed array sonar, passive ranging sonar, periscope, or ESM), each of which would have a different accuracy.

In elaborating on the various properties on the IID information types, if the details of a property are not known or unavailable to LMC, it is marked as "Unk" (unknown). Sometimes, a particular property is not relevant to a particular IID information type, in which case it is marked as "N/A" (not applicable).

2.3 Task 3 – Identify Problems and Recommend Solutions

Based on the IID Information Matrix completed in Task 1 and Task 2, we identified various potential problems and observations, including:

1. Issues or complications related to the suggested source for an IID information type, including where no practical source is available.

2. Cautions, considerations or issues related to suggested methods to make the information available from a source to the IID, including the feasibility of these methods.

3. Incompatibilities between the IID and source properties related to an IID information type, e.g., where IID uses units for data different than the data is provided by the source.

These problems and observations are listed in Table 1. For each of these problems and observations, also shown in Table 1 is LMC's recommended solution.

3 Results

Detailed information about each specific IID information type are provided in the IID Information Matrix described in Section 3.1. Recommended sources and methods to make the data available to the IID are described for each IID information type as part of the matrix. However, the general themes that emerged from the matrix regarding the sources for these IID information types are described in Section 3.2. Finally, Section 3.3 lists issues observed from the IID Information Matrix, and provides a recommended means to resolve these issues.

3.1 IID Information Matrix

The results of Task 1 and Task 2 investigations were recorded in an IID Information Matrix, as per Annex A.

In the first two columns of the IID Information Matrix:

1. "No." is the number assigned to each unique information type.

2. "IID Info Definition" is the description of the information type identified in Task 1.

The properties of the information type as currently assumed or used by the IID are specified in the IID Information Matrix in the following columns:

1. "IID Display Ref (Area)" indicates the specific IID Display Area that uses the indicated information type.

2. "Units" specifies the units needed by the IID.

3. "Resolution" is the least significant value of the information that is needed by the IID.

4. "Allowed Staleness" is intended to be the elapsed time before a refresh of the information type is required, as expected by the IID.

5. The first "Comment" column addresses notes and issues about the information type pertaining to its use by the IID.

The properties of an information type in the submarine systems that can provide the information type are specified in the IID Information Matrix as follows:

1. "Submarine System" is a potential submarine system source for the information type. Primary consideration was given to systems that have feasible "Potential Method(s) to Transfer Info to IID", as identified in the subsequent field in the IID Information Matrix.

2. "Publish/Subscribe Done" is specified as "Yes" if the identified system currently has a means to broadcast or make the data available for distribution, and "No" otherwise.

3. “Transmission Format” is the means by which the information type is transmitted, specified only when the previous “Publish/Subscribe Done” field is specified affirmatively.

4. “Potential Method(s) to Transfer Info to IID” are LMC’s suggestions for means whereby the indicated information type could be made available to the IID. LMC considered what it believed to be the most promising methods to provide data to the IID, with the least impact on systems and least requirement for engineering change.

5. “Time Between Data Refresh Within System” is the time between successive specifications of the data relevant to the information type as it is generated within the source system.

6. “Update Rate of Info Sent From System” is the rate at which data relevant to the information type is sent from the system.

7. “Units” specifies the units in which the information type is made available by the source.

8. “Resolution” is the least significant value of the information type data that is provided by the source.

9. “Security Designation” is the security level of the information type data provided by the source.

10. “Constraints” are special considerations, assumptions or limitations relevant to the information type that exist for the indicated submarine system source for that data.

11. “Prioritization of Multiple Systems” is LMC’s recommendation for the relative prioritization of the potential submarine system sources for the information type. Typically, this will be specified as “Low”, “Medium”, or “High”.

12. The second “Comment” column addresses notes and issues about the information type pertaining to the designated submarine system source for the information type.

In the IID Information Matrix, the purple text in the “IID Info Definition” column shows changes to, or new information types that were not listed in, the information requirement tables in the IID Design Document. The purple text in the first “Comment” column elaborates on the changes or additions made to the list of information types, or points out assumptions to be confirmed or questions to be answered by DRDC Atlantic. The blue shaded rows are information items from the IID Design document that were already covered by a similar information type elsewhere in the matrix, from one of the other IID display Areas. Each of the unique information types in the Information Matrix is assigned a number (the blue shaded rows, indicating redundant information types, are unnumbered).

3.2 General Comments on IID Information Sources

Sources specific to each IID information type are provided in the IID Information Matrix. The following are general observations and comments from consideration of all these IID information types.

1. As indicated in the IID Information Matrix, a substantial portion of the information types are not currently routinely broadcast or otherwise routinely receivable by IID. This includes sonars, ESM, and many other systems that pass data to CCS 876. To make information available directly from the systems that do pass information to CCS 876 would require significant engineering changes (ECs) to these individual systems. Alternatively, all this information can be provided from one source, CCS 876, with very minimal change. Specifically, CCS 876 has a "Unicast" capability already existing that provides real-time broadcast of all Data Gathering System (DGS) data generated by CCS 876. DGS data includes most of the relevant information from all these reporting systems. It is accessible from a simple Ethernet connection (to existing ports) on a CCS 876 console, and setup/specification at CCS 876 of the appropriate IP address at IID of the port to receive the data. The only required work to access the data is the development of an interface module at the IID that would receive the DGS data, interpret it (DGS data is sent in a defined message format, as per references [5], [6]), and parse it appropriately for IID.

2. Not all CCS 876 data is intrinsically Classified. However, in the context of an operational submarine, it is expected that in general CCS 876 data, particularly the Unicast data, will be Classified.

3. For the most part, there is currently no routine connection or access to repositories of historical data relevant to the historical information types (e.g., Nos. 72, 97, 113 in the IID Information Matrix). For example, some systems do accumulate history data, but typically extensive engineering changes to these systems would be required both to access and broadcast such data. Consequently, it is not currently practical to supply data for the historical information types (i.e., the complete record of all older data) directly from the submarine systems. Instead, it is recommended that the IID maintain a historical database of relevant data based on the accumulation of "real time" versions of such data that is provided from various sources to the IID.

4. There is a variety of "a priori" data (charts, tables, reference documents, threat sheets, etc.) that is the basis for data needed by various IID information types. Given the lack of current or easily implemented methods to provide most such "a priori" data directly from various submarine systems to IID, it is recommended to find alternative means to make such information available to IID. The most obvious solution is to simply separately load the "a priori" data into the IID as well as the relevant submarine systems. This would of course necessitate the development of IID modules to hold and read these databases, and format data to be used according to the same criteria and conditions as the systems on which the "a priori" data was originally installed. To some extent, this may involve replicating the same conditions, or knowledge of these conditions, as on the submarine system at the IID in order for the IID to use the same "a priori" data. In some cases, where the "a priori" data is hard-copy (e.g., paper charts, manuals), it may be necessary to convert this data to a format that can be used by the IID.

5. There are several IID information types that are used to define scale or parameters for IID display graphics, or control aspects of the IID displays (e.g., Nos. 19, 20, 26, 27, 135, 136, 181). These have been designated "IID Control Input" in the Source field in the IID Information Matrix. If these IID information types are intended to be dynamic and cannot be hard coded into the IID software, they would need to be done as manual inputs into the IID as

part of IID control. If the IID intends to vary the values for these information types based on observed conditions, then knowledge of some of the other routinely sent IID information types that characterize these conditions may be required. On the other hand, in most instances, these parameters remain at the total discretion of IID operators, and require no information from submarine systems.

6. There are several IID information types (e.g., Nos. 7, 21, 23, 28, 34─37, 54, 55, 58, 59, 62, 76, 81, 88─90, 101, 102, 120, 134, 137─139, 141, 143, 144, 146, 150) that in the IID Information Matrix have Submarine System designated as "Command Input" and Potential Method to Transfer Info to IID designated as "Manual Input". They involve Command decisions and choices for information types like planned speed, depth, etc. that are not recorded electronically on any submarine system. Consequently, they would need to be manually entered into the IID. It is possible the collection/recording of this data could be accomplished via the "remote device" approach described in item 7.

7. There are many IID information types, specifically those in the IID Information Matrix that have Source specified as "Manual Data Collection" (e.g., Nos. 3─6, 10, 11, 100, 152─163, 167, 173, 174) or "Planning Inputs" (e.g., Nos. 121─132), which aren't really tied to any current submarine system, and for which the only feasible method to make data available to the IID would be through manual input. However, we do believe it is possible to greatly improve the methods by which this data is collected or produced that would make it considerably easier for the IID to acquire this information. The current necessity for manual data entry and the quantity of information involved is overwhelming to be completed in just one location. We recommended the introduction of new "remote devices" (e.g., tablet, laptop) to collect and produce the desired data at the locations on the submarine where the relevant activities are most productively conducted. We see four primary functionalities/locations of use for these remote devices:

   a. CO's unit for Command inputs, which could be used in the CO's cabin (with portability as required). In addition to providing Command with the tools to plan missions and schedule events, this remote access will allow the CO to relay night orders, broadcast routine and communication plans, navigational ETAs, mission orders, CO intentions, tactical primary/secondary objectives, and snort routines.

   b. A unit for Nav O, Ops O, and trainee inputs, which could be used in the Wardroom. Much of the planning for inshore operations is currently done on paper charts. The remote device could serve as a more effective mission planning tool, allowing the CO and trainees to plan undisturbed, save and present their Command briefings, and make results available to IID as appropriate.

   c. Chief and PO's (C&PO's) unit for mechanical, electrical, Combat Systems Engineer's inputs, which could be used in the C&PO's Mess. Currently, much of the information that is needed by the IID is recorded on "tally boards" with grease markers. Mechanical information such as fresh water, fuel supplies, and battery dips (which would be used to calculate and update battery endurance estimates based on current speeds) are recorded in logs outside of the C&PO's Mess, which is also the ship's damage control centre "HQ1". Combat system defects, repairs, and system degraded implications could also be entered at this location and transmitted to the IID for display to Command. This would replace

paper logs/records as this information could be saved and backed up. In a damage control situation, access to appropriate damage control cards could be provided at the remote device. The IID in this situation could be updated from this unit, providing the CO with vital real time float, move, and fight data. As well, check lists such as Open Up for Dive, Smoke Clearance, and Damage Control Checks could also be entered at this location and displayed on the IID.

d. A Sound Room unit for sensors, tactical and classification inputs, as well as RCN range prediction software. The remote entry device would produce a ray path plot and along with the COI's detection/the sub's evasion depth based on the current bathy could immediately be transmitted to the IID display. The unit would also allow for real time contact classification details to be directly passed to the IID and enhance the Sound Room record keeping abilities by allowing their data to be saved to a file. Other information that could be saved would eliminate the necessity for Sound Room contact and tape recording logs. COI threat sheets, next bathy, atmosphere monitoring, and EW danger levels would be entered at the Sound Room location.

These remote devices would be loaded with relevant "a priori" information and new applications to support specific activities heretofore largely manual and paper-based. For example, an ECPINS-like capability for chart data would likely be required on the CO and Wardroom units. These devices could be networked as appropriate (i.e., to the IID to exchange information). This scheme has the potential to make the IID a hub for planning results and a display point for what is currently numerous paper records.

Transitioning such activities to a remote device would make them more efficient, more accurate, allow a detailed, consistent, permanent record to be maintained, and provide a simple means to provide information needed by the IID but likely not otherwise easily available to it. The remote devices would also reduce the personnel traffic in the Control Room. Effort would be required to define and develop the applications for the appropriate remote devices, and define and implement the appropriate network connections to IID. However, the network requirements would be fairly minimal, and could be integrated with other required network infrastructure upgrades being planned for the submarines. Lockheed Martin has been involved in such network studies, as per reference [7]. Furthermore, there would be negligible impact on other current submarine systems, and no need for potentially complicated and costly ECs to these systems.

8. There did not appear to be any explicit mention of the use of Automatic Identification System (AIS) in the information types elaborated in reference [1], apart from how they could be used to contribute to general contact related information types (e.g., contact position). Currently on the submarine, AIS data is received, but not systematically integrated (apart from possible manual input) into the contact data processed by CCS 876. When used, a dedicated AIS view/layer is presented (e.g., on SDM). Consequently, in the definition of IID information types in the IID Information Matrix, a separate AIS IID information type was included, and it is recommended that it be incorporated in the Area 4 display as an independent layer. Since the AIS data is not integrated into CCS 876 contacts, it is probably not productive, and perhaps even misleading, for the IID to attempt to associate or fuse the AIS data with current CCS 876 contact data as part of the contact-related IID information types (for position,

course, speed, etc.). A suitable AIS interface would need to be developed for the IID, and IID displays appropriately updated to incorporate AIS data as suggested.

3.3 Analysis of IID Information Matrix

Table 1 below describes some of the principal issues (and their recommended solutions) from the IID Information Matrix. The IID Information Matrix should be examined directly for the discussion of issues relevant to each individual IID information type.

Table 1: Issues from Information Matrix and Recommended Solutions.

No.	Issues and Observations	Recommended Solution
1.	Geographic plots will need ownship and target course and speed data specified w.r.t. ground, while conventional tactical plots (e.g., like those on CCS) will require ownship and target course and speed specified w.r.t. the water mass in which the submarine resides (with the assumption that all platforms in the water mass experience the same movement of the water mass).	Area 4 related information types will be specified w.r.t. ground, while most of the remaining Area displays will use information types specified w.r.t. water mass.
2.	Accurate data for ownship course and speed w.r.t. ground, as well as latitude/longitude position, may be problematic when dived.	Ownship course and speed w.r.t. ground will rely on INS/GPS data. When GPS data is available (e.g., when submarine is at periscope depth or above), INS/GPS is quite accurate. However, when dived, GPS is not available, and only the course and speed w.r.t. water mass is precisely measured, while course and speed w.r.t. ground must be determined using estimates for speed and direction of the water mass (including from tables/charts of current). Consequently, INS data for position may be of limited accuracy. This is all part of the "Pool of Error" estimate integrated into SDM, which itself may evolve pending possible future upgrades to SDM.

No.	Issues and Observations	Recommended Solution
3.	Contact position on submarine systems is never shown in the context of geographic plots, i.e., in latitude/longitude plots (with the exception of when contacts are part of independently presented AIS data). Instead, contact position is shown w.r.t. ownship on what amounts to a locally flat Cartesian coordinate system.	To present CCS determined contact position data on a geographic plot, it would be necessary to add a module to IID that could convert CCS contact position data to latitude/longitude. Knowing ownship latitude/longitude (from ownship data) would allow orientation of the contact data within a geographic plot, and then suitable conversion of Cartesian flat-earth data on a contact to a curved coordinate system would be required to determine latitude/longitude of the contacts. However, it should be noted that when dived, the inherent inaccuracy of ownship data will also translate to similar inaccuracy in the converted contact position data.
4.	The information type for "Air Quality" (No. 3) was not specific about what aspects of air quality would be reported.	O_2, CO_2 and pressure leveles can be routinely monitored on Analox; CO levels can be monitored by Draeger tubes during damage control.
5.	LMC noted several IID information types (Nos. 41, 83, 84, 159, 160) that were included in the Virtual Victoria Data Model (reference [2]) for which there was no relevant description in the IID Design Document (reference [1]).	These information types were included in the IID Information Matrix.
6.	The IID Design Document (reference [1]) tends to use "contact" and "COI" interchangeably for many of its information types, when in fact the COIs are a designated set of contacts, which are therefore a subset of all contacts.	Unless otherwise specified, we have treated those IID information types listed as "contact/COI" in the description as applying in general to a contact. Information type No. 146 is a Boolean that can be used to designate whether a given contact has been identified as a COI.
7.	The IID Design Document (reference [1]) tends to refer to information types as "relative bearing" (Nos. 93, 104, 105, 110) in instances that really involve what is designated as "true bearing" in sensors/CCS terminology.	These information types have been re-labeled as "true bearing", and the sources that supply them also consider true bearing.

No.	Issues and Observations	Recommended Solution
8.	IID information type No. 140 deals with "Sensors holding contact". However, there is no simple way to provide access to data directly from sensors. Furthermore, even the concept of a primary "reporting" sensor is not really used or maintained in CCS, apart from perhaps a verbal instruction to an operator to stop cutting contacts through to CCS. A similar issue is involved in the determination of "Previous Sensor Fixes" (No. 97).	DRDC should clarify the intended purpose of this information type. If it is sufficient to know what sensors are cutting data to CCS, this can be fairly easily interpreted from the proposed IID use of CCS 876 Unicast data by just monitoring what sensor data is being updated in the Unicast message stream. Any other interpretation requiring access directly to sensor data would be difficult to implement.
9.	Unlike the weapons status data that is available to CCS 876 via the Weapon System Data Bus, there is no equivalent broadcast of SSE status data. Consequently, there is no convenient method to convey SSE related data directly to IID.	SSE status/inventory will only be available to IID by manual input or manual data collection.
10.	There is an IID information type (No. 119) that represents the sonar waterfall display. At best, if the waterfall display video could be output from the sonar, there would be no way to present only the waterfall portion and exclude the menus that are also a part of the video display.	If the waterfall displays are required, it will probably be necessary to include the menus that are part of these sonar displays.
11.	No suitable source of altitude is currently available. Consequently, the "contact altitude" IID information type (No. 84) has no source for data in a submarine system.	At best, an operator or Command estimate could be made about contact altitude and manually input to IID.
12.	Contact behaviour is not analyzed or maintained systematically or in any automated manner by current submarine systems. Consequently, there is no source for IID information types "COI change behaviour" (No. 106) and "Contact/COI recent behaviour" (No. 114).	The raw contact data that can be used to perform the situation assessment to determine contact behaviour is potentially provided to IID (via CCS 876 Unicast). It is therefore feasible to develop modules in the IID that would perform the requisite behaviour analysis.

No.	Issues and Observations	Recommended Solution
13.	In CCS 876, tracks either are or are not included on the Threat Tote (up to 8 tracks can be assigned). No attempt is made to assign a quantitative threat value or relative ranking of the threats. Consequently, there is no source for IID information type "Threat level associated with COI" (No. 115) beyond a simple "threat/not a threat" designation for a contact.	Apart from whether or not a contact is on the CCS Threat Tote, any relative or quantitative evaluation of the threats would have to be done in an IID module using the CCS 876 Unicast data potentially available to IID. The only alternative would be Command designations about threat level that would be manually input to the IID.
14.	We noted minor differences in many of the information types between the units for data as needed by the IID and the units in which the data is provided by the system source. Common examples of the variations are metres vs. feet, Nautical Miles vs. yards, degrees vs. radians, and Knots vs. yards/sec.	These are simple unit conversions that should be coded as part of the IID interface modules that receive and process the data provided by the submarine system sources.
15.	IID information types No. 86 and 87 present data at the IID in hours, but the source information is measured as a percentage.	To present the required units for the data at the IID (i.e., in hours), in addition to the measured source data (specified as a percentage), it will be necessary to have a baseline value for total battery capacity to make the conversion to hours.
16.	No bathy and ray path plot history data is maintained for the IID in the available design documents.	We have proposed means to make bathy/ray path data available to the IID. It is recommended that a historical record of this data be maintained by the IID.

4 Conclusions

4.1 Summary of Findings

An IID Information Matrix was produced (see Annex A) that describes 183 unique information types needed by the IID. For each of these, we identified potential submarine system source(s), recommended method(s) to make this information available to the IID, and listed properties of the information types, both as needed by the IID and as available from the source.

The primary areas of new development to support making important information available to the IID are:

1. Provide an interface module, likely best suited as part of the IID software, which would receive, interpret and parse CCS 876 Unicast data. This interface is not a complicated programming problem (a related parser has been developed, as per reference [5], for other tasks), yet would make available to IID almost any data processed by CCS 876 (including most of the data passed to it from sensors and weapons).

2. Introduce several remote devices (e.g., tablet or laptop), and develop relevant applications for them, to provide data for IID information types that would require manual data collection or result from planning activities whose results would otherwise not be available to the IID.

3. Modify the IID software to read, store, and display/process as needed data corresponding to "a priori" information supplied to various submarine systems that is also needed by IID. This "a priori" data should be loaded onto IID separately when also loading on the originally intended submarine systems. In addition, it may be beneficial to convert data that currently exists only in a hardcopy format to an electronic format that could be used as needed on the IID, or the suggested remote devices.

4. Modify the IID software so that all historical data needed by the IID can be stored internally to the IID. Where there is a stated need for historical data, means have been suggested to make the real-time versions of this data available to IID. IID should be suitably modified to record, maintain, and access this data as needed.

5. Provide for manual entry into the IID of appropriate data, including most Command inputs, information that cannot be otherwise feasibly obtained from submarine systems, and data that is specifically intended as IID control inputs separate from any submarine system.

6. Introduce AIS data into the IID geographic display (Area 4) as a distinct layer, separate from other CCS based contact data that is displayed.

An analysis of the IID Information Matrix pointed out a variety of potential issues about the IID information types and how to make the data for them available to the IID. These issues are listed in Table 1. Also provided in this table is a recommended solution for each of these issues.

4.2 Discussion of Outstanding Issues

The following are issues that arose from this study, but for which there were no specific LMC recommendations to resolve:

1. Not much information was available in the IID reference documentation made available to LMC concerning the "Allowed Staleness" of the various information types as needed by the IID, so this field is largely designated as Unknown in the IID Information Matrix.

2. The IID information type properties of accuracy of the information type needed by the IID and accuracy of the information as provided by the source were eliminated from consideration due to lack of information in the available IID design documentation for the former, and because of the difficulty in accessing the information and Classified nature of the data when it is available for the latter. Consequently, no inconsistencies between accuracy needed by IID and accuracy available from source were examined. If this is critical information, then it will be necessary to acquire more detailed documentation on both the IID design, and performance specs and analysis on the submarine information sources.

3. No practical source of information is available for the following IID information types:

   a. Contact altitude (No. 84 in the IID Information Matrix).

   b. COI change behaviour (No. 106).

   c. Contact/COI recent behaviour (No. 114).

   d. Threat level associated with COI (No. 115).

   For items b through d, if the IID adopts the recommended use of CCS 876 Unicast data, then all the raw data would be available to develop appropriate situation and threat assessment modules as part of the IID to make these types of evaluations possible as part of IID function.

4. Lack of documentation on SDM limits the insight LMC can provide on the use of SDM as a source for relevant IID information types, the methods by which information can be made available from SDM, and the properties of the SDM-related IID information types. However, LMC has sufficient fundamental understanding of SDM that our key recommendations and conclusions regarding sources and methods of availability for IID information types that could potentially involve SDM would not be substantially altered. In particular, items 4 and 7 in Section 3.2 present alternative approaches for supplying information to the IID that might otherwise have to be drawn from SDM.

5. For those IID information types that have the source listed as SDM, it should be recognized that there is no simple way to make SDM data electronically available to IID. In some cases, data thought of as SDM-related has already been alternatively sourced in the IID Information Matrix. For example:

   a. "a priori" data held at SDM (e.g., charts) could alternately be loaded on IID when loading on SDM.

b. External data read into SDM can simultaneously be read into IID, e.g., AIS.

c. Some planning capabilities that use or produce information that could appear on SDM may be more suitably done on remote devices, as discussed earlier.

However, where there is no reasonable alternative to SDM for the IID to acquire data, it should be noted that there are immediate plans for a hardware upgrade to SDM. This may provide an opportunity for suitable ECs to SDM to make any necessary data available to IID. A further investigation would need to be conducted on the scope of changes to be made to SDM, and whether changes required for IID could be accommodated. In the interim, any information needed from SDM would likely have to be obtained via manual input. Fortunately, our other recommended courses of action for obtaining data related to the IID have minimized this requirement.

6. LMC reviewed high level documents for the CSS (e.g., reference [4]), but there was not much detail in the available documentation about new subsystems that might be integrated to the CSS and have data that may be relevant to the IID. Most of our projections about the CSS as as a source of data and the means to provide it to the IID are based on our working knowledge of the current Surveillance System and the general information in the indicated reference documents. As more detailed design and interface specifications for the CSS come available, it may be feasible to update the methods to provide data to the IID for a few of the relevant IID information types. Regardless, in the IID Information Matrix, any information type for which the Source is specified as "CSS" will likely require additional design changes to the CSS to enable such information to be output to the IID.

4.3 Recommended Way Ahead

The following items are LMC's primary recommendations for the way ahead in providing information from submarine systems to the IID:

1. Implement an interface to CCS 876 Unicast, likely as a module within IID software.

2. It was recommended that several "remote devices" (e.g., tablet, laptop) should be introduced to provide data for IID information types related to manual data collection, some planning activities, etc., as described in the IID Information Matrix. It is suggested that there probably should be a more general investigation of various submarine activities and processes that could benefit from various automated support tools on remote devices, for which the applications and devices needed for IID would be an important, but properly coordinated, subset. This would obviously benefit the IID in that data for IID information types that might not otherwise be available would be provided. However, it would simultaneously improve the capabilities and performance of the applications transferred to and performed on these remote devices, and thereby benefit overall VCS performance.

3. Develop a suitable interface for the IID to be able to receive AIS data, and update the IID displays to be able to incorporate the AIS data as suggested in Section 3.2 item 8.

4. Determine whether there are any indicated sources of “a priori” data (particularly those that may exist only in a hard-copy format) that should be converted to a format that is useable by the IID, and develop an appropriate interface for the IID to use this data.

5. LMC is currently implementing a significant upgrade to the Tactical Weapons Systems Trainer (TWS) in S17 at CFB Halifax, to be completed in FY13/14. The primary objective for the upgrade is to facilitate overall integration testing of current fitted systems with future Combat Systems ECs. Once the upgrade is complete, the TWS would be an ideal location to develop and validate the proposed methods to make information required by the IID available from submarine systems. This would hold especially for next generation systems that will be available for testing in the TWS prior to any other venue. Furthermore, the Submarine Division staff and students could/would readily provide feedback on concepts in aid of any formal project progression. It is recommended that in the short term (within the next FY) DRDC Atlantic undertake to produce prototype IID hardware and software to fit in the TWS, and develop the Unicast interface that will ultimately take data from the CCS 876 Tech Refresh System to be installed in the TWS Q2 14. At the same time, other suggested methods to utilize system sources available in the TWS can be investigated and developed as appropriate. This work could be done in parallel with the VCS backbone refresh currently being designed by Lockheed Martin.

6. Consideration could be given to the following three fitted sensor systems (with recommended upgrades in bold) for input to the IID through the Combat System LAN:

   a. 2004 Sound Velocity (SV) Meter upper/lower sound (**A-D both outputs broadcast to CS LAN**).

   b. Ownship Noise (OSN) Hydrophones discrete data (**A-D all outputs broadcast to CS LAN**).

   c. 189 Cavitation Indicator (**A-D single output broadcast to CS LAN**).

   Individually, these upgraded continuous outputs would provide significant platform self and situational awareness, presumably a goal of the IID. A simple combing algorithm could be developed to add considerably more value.

References

[1] Human Systems Inc. 2011. Conceptual Design for the C2 Information Integration Display. Defence Research and Development Canada, Atlantic.

[2] Defence Research and Development Canada, Atlantic. 2013. Virtual Victoria Data Model. Defence Research and Development Canada, Atlantic - Unpublished.

[3] Human Systems Inc. 2012. Assumptions and Specifications Matrix. Defence Research and Development Canada, Atlantic - Unpublished.

[4] DND Canada. 2011. HMI Software Design Document Central Surveillance System (CSS). DND Canada.

[5] Lockheed Martin MS2. 5 August 2010. Data Gathering System Analysis Tool (DGSAT) Version 3.4 User’s Guide. Lockheed Martin INT-09-030.

[6] Lockheed Martin MS2. 5 August 2010. Data Gathering System Format Document (Technical) For the Victoria Class Submarine Fire Control System. Lockheed Martin INT-09-031.

[7] Lockheed Martin MS2. 19 September 2008. Victoria SFCS Network Study (Task 2) Report (Final). Contract W8482-071036/001/QF.

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Annex A IID Information Matrix File

The results of Tasks 1 and 2 were recorded in the IID Information Matrix. A description of the fields used to organize these results is provided in Section 3.1.

Purple text = Issues to be addressed by DRDC.

= Info Item is redundant (already accounted for)

	Properties of Information for IID						Properties of Required IID Information in the Submarine System(s) in Which It Is Available											
No.	IID Info Definition	IID Display Ref (Area)	Units	Resolution	Allowed Staleness	Comment	Submarine System	Publish/ Subscribe Done	Transmission Format	Potential Method(s) to Transfer Info to IID	Time Between Data Refresh Within System	Update Rate of Info Sent From System	Units	Resolution	Security Designation	Constraints	Prioritization of Multiple Systems	Comment
1	DTG: Time of Day	Area 1					NTP XLI	Yes	NMEA-0183 using 100 Base-T Ethernet Standard data.	Primary Method: CCS Ethernet Switch (A1A5) located on the back of CCS Consoles. Secondary Method: Retrieve data from LAN1 Ethernet Switch located next to SDM.	Seconds	Seconds	Hrs,Mins,Secs	Nanoseconds	UNCLASS	Nil	High	The NTP Time Server provides data to the LAN1 Switch and CCS 876 via RJ45 Ethernet at 100 MB/sec. The XLI accuracy is 30ns RMS UTC. It would be beneficial to utilize the NTP Server to reduce any sync and delay issues.
			Hrs,Mins,Secs	Seconds	Unk		CCS	No	N/A	CCS UNICAST - Ownship Message	Seconds	Seconds	Hrs,Mins,Secs	Nanoseconds	CLASS	Nil	Low	The Time of Day is transmitted via UNICAST to a determined IP address. This data would be available in the Ownship Message which identifies the "Time Stamp Nanoseconds" within a 32-bit signed integer, which contains the number of Nanoseconds after the time stamp seconds value for when this message was recorded.
2	DTG: Date	Area 1			Unk		NTP XLI	Yes	NMEA-0183 using 100 Base-T Ethernet Standard data.	Primary Method: CCS Ethernet Switch (A1A5) located on the back of CCS Consoles. Secondary Method: Retrieve data from LAN1 Ethernet Switch located next to SDM.	Seconds	Seconds	Julian Date,Hrs,Mins,Secs,Year.eg:052.21.37.42.2013	Nanoseconds	UNCLASS	Nil	Low	The NTP Time Server provides data to the LAN1 Switch and CCS 876 via RJ45 Ethernet at 100 MB/sec.
3	Air quality	Area 2, Area 7	PPM	1	Unk	What are they referring to as AIR QUALITY? Do you want to know if the atmosphere is in spec or do they want to know specific O2, CO2, CO…readings. The graph shows a "PPM" reading but does to say to what.	Manual Data Collection	No	N/A	Analox Monitor\Drager - Manual Input by Radio Operators	Every 6 Hours	As dictated by Comd, driven by Tactical Ops or Damage Control Situation.	PPM	1	UNCLASS	Nil	N/A	The current method of retrieving the air quality onboard is by utilizing the Analox monitor. The Analox monitor is a portable device which the operator must retrieve air quality levels from each designated compartment and manually record levels. There is no autmoated method of retrieving this information at this time. Therefore, the operator would be required to manually enter the air quality results into the IID.
4	Air quality: O2 level	Area 2, Area 7	PPM	1	Unk	New.	Manual Data Collection	No	N/A	Analox Monitor\Drager - Manual Input by Radio Operators	Every 6 Hours	As dictated by Comd, driven by Tactical Ops or Damage Control Situation.	PPM	1	UNCLASS	Nil	N/A	0-2000mBar ppO2/0-2.000ATS ppO2 O2 Level should be 18 - 20%.
5	Air quality: CO2 level	Area 2, Area 7	PPM	1	Unk	New.	Manual Data Collection	No	N/A	Analox Monitor\Drager - Manual Input by Radio Operators	Every 6 Hours	As dictated by Comd, driven by Tactical Ops or Damage Control Situation.	PPM	1	UNCLASS	Nil	N/A	0.1-10% SEV ppCO2 (Surface Equivalent Value) CO2 Level Maximum is 4.5%.
6	Air quality: CO level	Area 2, Area 7	PPM	1	Unk	New.	Manual Data Collection	No	N/A	Drager - Manual Input by Radio Operators	Damage Control Situations	As dictated by Comd, driven by Damage Control Situation.	PPM	1	UNCLASS	Nil	N/A	See Air Quality. CO Level Maximum is 0.01%.
7	Air quality limit	Area 2	PPM	1	Unk		Command Input	No	N/A	Fixed Input in IID or Manual Input	As Required	As Required	PPM	1	UNCLASS	Nil	N/A	The Air quality limits must be either fixed values in the IID or must be entered in manually As per Medical Directives & SOP's.
8	Fuel Level: fuel remaining	Area 2	Percentage	0.01	Slow		Operator Input	No	N/A	Manual Input - Remote Input	N/A	Daily	Percentage	1	UNCLASS	Nil	N/A	The fuel levels are reported daily to CO. The percentage would be derived from the known capaticy.
9	Fuel Level: low level fuel limit	Area 2	Percentage	0.01	Fixed	Provided by Comd, not a constant, value driven by operational commitments.	CSS	No	N/A	Fixed Input in IID or Manual Input	Unk	Unk	Percentage	1	UNCLASS	Nil	N/A	
10	Battery Endurance (current)	Area 2	Hours	0.1	Slow		Manual Data Collection	No	N/A	Manual Input	N/A	As directed by Comd, battery dips as required by operational situation.	Percentage	1	UNCLASS	Nil	N/A	Accuracy related to Hydrometer reading. "Operator" dependant.
11	Battery endurance limit	Area 2	Hours	0.1	Slow		Manual Data Collection	No	N/A	Manual Input	N/A	As directed by Comd, battery dips as required by operational situation.	Percentage	1	UNCLASS	Nil	N/A	Accuracy related to Hydrometer reading. "Operator" dependant.
12	Pitch and Roll	Area 2	Degrees	0.1	Fast		NDDS	Yes	Primary MethodNMEA-0183 using 100 Base-T Ethernet Standard data. Secondary Method: Synchro Output	Primary Method: CCS Ethernet Switch (A1A5) located on the back of CCS Consoles. Secondary Method: NDDS.	Seconds	Seconds	Degrees	0.01	UNCLASS	Nil	N/A	on CCS, the they are transmitted to the CCS and availiable. Pitch/Roll can be obtained by connecting directly to the RJ45 Ethernet Switch (A1A5) on the back fo the CCS consoles. Seondary Method: There are currently multiple Pitch and Roll outputs available from the NDDS. NDDS Source - Synchro Interface Boards - Roll - 1A2-J8-1, 1A2-J8-2, 1A2-J8-3 - Pitch - 1A4 - J7 -1, 1A4 -
13	Trim	Area 2	Degrees	0.1	State Change		Autopilot	No	N/A	See Comment	Unk	Unk	Unk	Unk	UNCLASS	Nil	N/A	The Trim angle is currently a analog function. The OMC/Autopilot EC will incorporate a digital output that would be most likely be more feasible.
	~~Ownship Bearing and Ownship Course~~	Area 2				We really mean just "ownship course". Ownship "bearing" would only be relevant w.r.t. a reference point, which is likely not practical. IID should really distinguish between OS course (and speed) w.r.t. ground and OS course (and speed) w.r.t. water mass. Couse (and speed) w.r.t. Water Mass applies to Area 2.												
	Ownship Course w.r.t. Ground	- (Area 4)				New, not used in Area 2.												
14	Ownship Course w.r.t. Water Mass	Area 2, Area 5-Rel Brg				New. This is the course applicable to Area 2.	CCS	No	N/A	CCS UNICAST - Ownship Message	Seconds	Seconds	Radians	0.001	CLASS	Nil	High	The Ownship Course is transmitted via UNICAST to a determined IP address. This data would be available in the Ownship Message which identifies the "Heading" within a 32-bit floating number.
			Degrees	1	Fast		NDDS	Yes	NMEA-0183 using 100 Base-T Ethernet Standard data.	Primary Method: CCS Ethernet Switch (A1A5) located on the back of CCS Consoles. Secondary Method: Retrieve data from LAN1 Ethernet Switch located next to SDM.	Seconds	Seconds	Degrees	0.001	CLASS	Nil	Low	Primary Method: Ownship Depth can be obtained by connecting directly to the RJ45 Ethernet Switch (A1A5) on the back fo the CCS consoles at 100 MB/sec. Seondary Method: Connect to LAN1 Switch.

			Properties of Information for IID				Properties of Required IID Information in the Submarine System(s) in Which It Is Available											
No.	IID Info Definition	IID Display Ref (Area)	Units	Resolution	Allowed Staleness	Comment	Submarine System	Publish/ Subscribe Done	Transmission Format	Potential Method(s) to Transfer Info to IID	Time Between Data Refresh Within System	Update Rate of Info Sent From System	Units	Resolution	Security Designation	Constraints	Prioritization of Multiple Systems	Comment
15	Planned Route/ nav plans: Planned ~~Bearing~~ Course w.r.t. Water Mass	Area 2, Area 6 (Planned route/nav plans) [Planned Course, Planned Depth]	Degrees	Unk	Unk	Should be labelled Planned "Course", NOT "Bearing".	SDM	No	N/A	Extract Data Electronically from SDM	Unk	Unk	Degrees	0.001	CLASS	Nil	N/A	Requires major software EC to SDM to extract data from SDM. The workaround would be to manually extract the data.
16	Rudder angle	Area 2	Degrees	0.1	Fast		Autopilot	No	N/A	See Comment	Unk	Unk	Degrees	Unk	UNCLASS	Nil	N/A	The Trim angle is currently a analog function. The OMC/Autopilot EC will incorporate a digital output that would be most likely be more feasible.
17	RPM	Area 2	RPM	1	Fast	New	OMC	No	N/A	See Comment	Unk	Unk	Rev/Min	0.1	CLASS	Nil	N/A	The RPM is fed from LEU1 on the Propulsion Motor via Interface Board PT/IM in Rack 3 in the SCC.
18	Ownship depth	Area 2, Area 3					CCS	No	N/A	CCS UNICAST - Ownship Message	Seconds	Seconds	Feet	0.001	CLASS	Nil	N/A	The Ownship Depth is transmitted via UNICAST to a determined IP address. This data would be available in the Ownship Message which identifies the "Depth" within a 32-bit floating point number.
			Meters	1	Fast		NDDS	Yes	NMEA-0183 using 100 Base-T Ethernet Standard data.	Primary Method: CCS Ethernet Switch (A1A5) located on the back of CCS Consoles. Secondary Method: Retrieve data from LAN1 Ethernet Switch located next to SDM.	Seconds	Seconds	Meters	0.001	CLASS	Nil	N/A	Primary Method: Ownship Depth can be obtained by connecting directly to the RJ45 Ethernet Switch (A1A5) on the back fo the CCS consoles at 100 MB/sec. Seondary Method: Connect to LAN1 Switch.
	~~Ownship depth: Position in depth bracket~~	Area 2, Area 7				Will require info type for ownship depth. This item has been supplanted by the "Depth value for top/bottom of depth bracket", "Safe depth limit".												
19	Depth value for top of depth bracket	Area 2, Area 7	Meters	1	Fixed	Is the top of depth bracket fixed at 0?	IID Control Input	No	N/A	Fixed Input in IID or Manual Input	As Required	As Required	Meters	0.1	CLASS	Nil	N/A	This will be a fixed value set at a depth of 0 Meters.
20	Depth value for bottom of depth bracket	Area 2, Area 7	Meters	1	Fixed	Is this the lower limit Chart Depth (read from some appropriate info type), a fixed depth, or some arbitrary number appropriate to scale.	IID Control Input	No	N/A	Manual Input	As Required	As Required	Meters	0.1	CLASS	Nil	N/A	
21	Safe depth limit	Area 2, Area 7	Meters	1	Unk	The depth bracket graphic indicates a light blue safe depth region (and dark blue unsafe depth region). We will need a specification for the bottom limit as safe depth.	Command Input	No	N/A	Manual Input	As Required	As Required	Meters	0.1	CLASS	Nil	N/A	TheSafe Depth Limit must be determined by Command and entered manually into the IID. The Safe Depth Limit will vary throughout deployments.
22	Planned Route/ nav plans: Planned Speed w.r.t. water mass	Area 2	Knots	0.1	State Change	Corresponding graphic will require current speed (from SFCS or ECPINS), which is covered in other info types. This line item (in the Design doc) does not refer directly to the planned speed (which is separately accounted for below).	SDM	No	N/A	Extract Data Electronically from SDM	Unk	Unk	Knots	0.1	CLASS	Nil	N/A	Requires major software EC to SDM to extract data from SDM. The workaround would be to manually extract the data.
23	Planned Route/ nav plans: Maximum Speed	Area 2	Knots	Unk	Unk	New. Corresponding graphic for "Planned Route/nav plans" requires maximum speed, which must be provided but is not specified anywhere else in IID Design Doc.	Command Input	No	N/A	Manual Input	Unk	Unk	Knots	0.1	CLASS	Nil	N/A	
24	Ownship Speed w.r.t. Water Mass	Area 2				New. Corresponding graphic includes actual OS speed, which is not explicitly mentioned in Area 2. There is also a similar issue as with OS Course as to the need to differentiate between OS Speed w.r.t. Ground or OS Speed w.r.t. Water Mass.	CCS	No	N/A	CCS UNICAST - Ownship Message	Seconds	Seconds	Yards/Second	0.001	CLASS	Nil	High	The Ownship Speed is transmitted via UNICAST to a determined IP address. This data would be available in the Ownship Message which identifies the "Speed" within a 32-bit floating point number.
			Knots	0.1	Fast		NDDS	Yes	NMEA-0183 using 100 Base-T Ethernet Standard data.	Primary Method: CCS Ethernet Switch (A1A5) located on the back of CCS Consoles. Secondary Method: Retrieve data from LAN1 Ethernet Switch located next to SDM.	Seconds	Seconds	Knots	0.001	CLASS	Nil	Low	The OS Spped can be obtained by connecting directly to the RJ45 Ethernet Switch (A1A5) on the back fo the CCS consoles at 100 MB/sec.
	Ownship Speed w.r.t. Ground	- (Area 4)				New, not used in Area 2.												
25	Planned Speed	Area 2	Knots	0.1	State Change	Area 2 graphic used for "Planned Speed" will need input for current Speed w.r.t. water mass.	SDM	No	N/A	Manual Input	As Required	As Required	Knots	0.1	CLASS	Nil	N/A	
26	Speed value at top of speed bracket graphic		Knots	0.1	Fixed	New. Area 2 graphic used for "Planned Speed" will need a value for speed at the top of the graphic. Will this be a pre-defined parameter or input value.	IID Control Input	No	N/A	Manual Input	As Required	As Required	Knots	0.1	CLASS	Nil	N/A	
27	Speed value at bottom of speed bracket graphic		Knots	0.1	Fixed	New. Area 2 graphic used for "Planned Speed" will need a value for speed at the bottom of the graphic. Will this be a pre-defined parameter or input value.	IID Control Input	No	N/A	Manual Input	As Required	As Required	Knots	0.1	CLASS	Nil	N/A	
28	Cavitation Speed	Area 2	Knots	0.1	Fixed		Command Input	No	N/A	Manual Input from Sound Room	As Required	As Required	Knots	0.1	CLASS	Nil	N/A	The Sound Room Operators will determine Cavitation Speed by taking into account such things as depth. The operators could enter the value into the IID or provide an estimated value for the IID.
29	Telegraph	Area 2	N/A	Position (State)	State Change		OMC	No	N/A	See Comment	Unk	Unk	Unk	State	UNCLASS	Nil	N/A	There is currently no simple way of extracting the data directly from the OMC without implementing an EC.
30	Grouper switch	Area 2	N/A	Position (State)	State Change		OMC	No	N/A	See Comment	Unk	Unk	Unk	State	UNCLASS	Nil	N/A	There is currently no simple way of extracting the data directly from the OMC without implementing an EC.
31	Ownship position	Area 2, Area 4				Digital Lat/Long	CCS	No	N/A	CCS UNICAST - Ownship Message	Seconds	Seconds	Degrees/Minutes/Seconds	0.00001	CLASS	Nil	High	The OwnshipPosition is transmitted via UNICAST to a determined IP address. This data would be available in the Ownship Message which identifies the "Latitude and Longtitude" within a 32-bit floating point number.
			Decimal Degrees	0.0001	Fast		NDDS	Yes	NMEA-0183 using 100 Base-T Ethernet Standard data.	Primary Method: CCS Ethernet Switch (A1A5) located on the back of CCS Consoles. Secondary Method: Retrieve data from LAN1 Ethernet Switch located next to SDM.	Seconds	Seconds	Degrees/Minutes/Seconds	0.00001	UNCLASS	Nil	Low	Primary Method: Ownship Position can be obtained by connecting directly to the RJ45 Ethernet Switch (A1A5) on the back fo the CCS consoles at 100 MB/sec. Seondary Method: Connect to LAN1 Switch.
	Ownship depth	Area 3, Area 2																

			Properties of Information for IID				Properties of Required IID Information in the Submarine System(s) in Which It Is Available											
No.	IID Info Definition	IID Display Ref (Area)	Units	Resolution	Allowed Staleness	Comment	Submarine System	Publish/ Subscribe Done	Transmission Format	Potential Method(s) to Transfer Info to IID	Time Between Data Refresh Within System	Update Rate of Info Sent From System	Units	Resolution	Security Designation	Constraints	Prioritization of Multiple Systems	Comment
32	Ownship ray traces	Area 3					CCS	No	N/A	CCS UNICAST - Bathy Message	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	High	The Sound Velocity Profile is transmitted via UNICAST to a determined IP address. The subtype is a 16-bit unsigned integer equal to BATHY_MSGID(1906). This transmission will include the time stamp for when the message was recorded, Lat/Long of when data was obtained, filename, probe type and the terminal depth. Note: Bathy profiles are currently entered into CCS manually, but will be transmitted to CCS via MK8F Bathythermograph upon EC completion.
			Unk	Unk	Unk		Bathy	No	N/A	MK8F Bathythermograph	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	Low	The Bathy connection is not currently connected onboard. The MK8F Bathythermograph transmits via Serial Binary modes and Serial ASCII modes. The Serial Binary modes are based on NTDS protocol.
33	Ownship ray traces: simulated ray traces associated with a simulated depth	Area 3	Unk	Unk	Unk		CCS	No	N/A	CCS UNICAST - Bathy Message	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	N/A	See Item #32. By utilizing the UNICAST Bathy Message SVP, the IID would need to create an Ownship Simulated Ray Trace associated with a simulated depth.
34	Contact/COI range ~~estimate~~ prediction	Area 3	Nautical Miles	0.1	Unk	In this context, COI range is a "predicted" value (e.g., based on manual inputs from soundroom), not necessarily from computed data, i.e., TMA (SFCS). Consequently, it will be maintained separately from the (originally) similarly named info types in Area 5-Rel Rng, Area 5-Rel Brg, Area 8-Weapons, but where the source is specified as SFCS.	Command Input	No	N/A	Manual Input from Sound Room	As Required	As Required	Yards	0.1	CLASS	Nil	N/A	Currrently, the range predictions are computed by utilizing the WADER software. It is suspected that the WADER Software will be replaced throughout the fleet shortly. The range predictions are currently done by the Senior Sonar Operator daily and posted in the Control Room. In the Future, the results from the range prediction software could possibly be transferred to the IID using a USB thumb drive or the data oculd be manually inputted.
35	Uncertainty of current contact/COI range	Area 3	Nautical Miles	Unk	Unk	IID Design Doc implies info comes from SFCS. However, this is presumably the uncertainty in the "COI range prediction" (see preceding info type), which is not SFCS data.	Command Input	No	N/A	Manual Input from Sound Room	As Required	As Required	Yards	100	CLASS	Nil	N/A	The currentl contact Uncertainty is based upon the time of day, weather conditions, daily temperature changes, seasonal effects, and oceanographic changes which may change throughout the day.
36	Contact/COI ray traces	Area 3	Unk	Unk	Unk		Command Input	No	N/A	Manual Input from Sound Room	As Required	As Required	Yards	100	CLASS	Nil	N/A	The CCS has the capabilty of providing a SVP Trace that the IID would need to create the COI Ray Traces.
37	Contact/COI depth	Area 3	Meters	1	Unk		Command Input	No	N/A	Manual Input from Sound Room	As Required	As Required	Meters	100	CLASS	Nil	N/A	The COI Depth is dependant upon the target. The draft and vessel type are available from sound room reference material.
	~~Contact/COI classification~~	Area 3				Throughout IID Design document, "classification" is used at various times to mean "Allegiance" (Friend, Hostile, Neutral, Unknown, ...), "Category" (Air, Surface, Sub-surface,...), or "Platform" (Submarine, Frigate, Destroyer, ...). Suggest changing the "Contact/COI classification" info type to one each for Allegiance, Category, Platform. Also added "Flag", as per Virtual VIC Data Model. In this instance, Category is intended.												
38	Contact/COI Allegiance	Area 3, Area 4, Area 5-Rel Rng, Area 5-Rel Brg, Area 8-Contact Mgt	2 Letter Designation	N/A	Unk	New.	CCS	No	N/A	CCS UNICAST - Threat Message	When New Data is entered	Minute	N/A	N/A	CLASS	Nil	N/A	The Contact/COI Allegiance is transmitted via UNICAST to a determined IP address. This data would be available in the Threat Message which identifies the "Designation" within a 32-bit unsigned integer. The Platforms are UNKNOWN, FRIENDLY, HOSTILE, or NEUTRAL.
39	Contact/COI Category	Area 3, Area 4, Area 5-Rel Rng, Area 5-Rel Brg, Area 8-Contact Mgt	2 Letter Designation	N/A	Unk	New	CCS	No	N/A	CCS UNICAST - Threat Message	When New Data is entered	Minute	N/A	N/A	CLASS	Nil	N/A	The Contact/COI Category is transmitted via UNICAST to a determined IP address. This data would be available in the Threat Message which identifies the "Class ID" within a 4 character array. For example Surface would be represented by SURF.
40	Contact/COI Platform	Area 3, Area 4, Area 5-Rel Rng, Area 5-Rel Brg, Area 8-Contact Mgt	2 Letter Designation	N/A	Unk	New.	CCS	No	N/A	CCS UNICAST - Threat Message	When New Data is entered	Minute	N/A	N/A	CLASS	Nil	N/A	The Contact/COI Platform is transmitted via UNICAST to a determined IP address. This data would be available in the Threat Message which identifies the "Class Type" within a 32-bit unsigned integer. The types are UNKNOWN, ASW HELICOPTER, FIXED WING, AIRCRAFT, SUBMARINE OR SURFACE SHIP.
41	Contact/COI Flag	Area 3, Area 4, Area 5-Rel Rng, Area 5-Rel Brg, Area 8-Contact Mgt	2 Letter Designation	N/A	Unk	New. Included in Virtual VIC Data Model; not clear if used in IID.	Command Input	No	N/A	Manual Input from Sound Room	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	The Contact/COI Flag information could be possibly entered remotely. The Flag may be determined by the detected sensors in use by contact.
42	Track numbers	Area 3, Area 4, Area 5-Brg Rate, Area 8-Contact Mgt, Area 8-Weapons	N/A	5 digit alpha numeric identifier	Unk		CCS	No	N/A	CCS UNICAST - Threat Message	When New Track Assigned	Minute	N/A	N/A	CLASS	Nil	N/A	The Track Numbers are transmitted via UNICAST to a determined IP address. This data would be available in the Threat Message identified as "Track ID" utililizing a 32-bit unsigned integer.
43	Sound velocity profile (SVP) of water	Area 3					CCS	No	N/A	CCS UNICAST - Bathy Message	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	High	The Sound Velocity Profile is transmitted via UNICAST to a determined IP address. The subtype is a 16-bit unsigned integer equal to BATHY_MSGID(1906). This transmission will include the time stamp for when the message was recorded, Lat/Long of when data was obtained, filename, probe type and the terminal depth. Note: Bathy profiles are currently entered into CCS manually, but will be transmitted to CCS via MK8F Bathythermograph upon EC completion.

No.	IID Info Definition	IID Display Ref (Area)	Units	Resolution	Allowed Staleness	Comment	Submarine System	Publish/ Subscribe Done	Transmission Format	Potential Method(s) to Transfer Info to IID	Time Between Data Refresh Within System	Update Rate of Info Sent From System	Units	Resolution	Security Designation	Constraints	Prioritization of Multiple Systems	Comment
	Properties of Information for IID						Properties of Required IID Information in the Submarine System(s) in Which It Is Available											
			Unk	Unk	Unk		Bathy	No	N/A	MK8F Bathythermograph	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	Low	The Bathy connection is not currently connected onboard. The MK8F Bathythermograph transmits via Serial Binary modes and Serial ASCII modes. The Serial Binary modes are based on NTDS protocol.
44	Charted depth	Area 3, Area 7	Meters	Unk	Unk	Area 3 should get its depth from the Bathy to determine if the ray path allows for CZ and/or Bottom bounce ranges. Area 7 depth of water and brackets refer to priority 1 and 2 alarms.	A Priori	No	N/A	Download Reference to IID	Unk	Unk	Meters	0.1	UNCLASS	Nil	N/A	
45	Time lateness of BATHY data	Area 3					CCS	No	N/A	CCS UNICAST - Bathy Message	When New Data Received	When New Data Received	Hour, Min, Sec	1	CLASS	Nil	High	The SVP Time Lateness can be indentfied via UNICAST in the Bathy Message. This message provides the Update Date/Time for update.
			Unk	Unk	Unk		Bathy	No	N/A	MK8F Bathythermograph	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	Low	The Bathy connection is not currently connected onboard. The MK8F Bathythermograph transmits via Serial Binary modes and Serial ASCII modes. The Serial Binary modes are based on NTDS protocol.
46	Convergence zones (CZ)	Area 3					CCS	No	N/A	CCS UNICAST - Bathy Message	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	High	The Convergence Zones can be indentfied via UNICAST in the Bathy Message. This message contains 29 SVP normal points, 29 SVP 400m points and 29 SVP 800m points. Each point will indicate Depth(ft) and Sound Velocity(ft/sec).
			Unk	Unk	Unk		Bathy	No	N/A	MK8F Bathythermograph	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	Low	The Bathy connection is not currently connected onboard. The MK8F Bathythermograph transmits via Serial Binary modes and Serial ASCII modes. The Serial Binary modes are based on NTDS protocol.
47	Sound channels	Area 3					CCS	No	N/A	CCS UNICAST - Bathy Message	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	High	See Item #46
			Unk	Unk	Unk		Bathy	No	N/A	MK8F Bathythermograph	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	Low	See Item #46
48	Shadow zones	Area 3					CCS	No	N/A	CCS UNICAST - Bathy Message	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	High	See Item #46
			Unk	Unk	Unk		Bathy	No	N/A	MK8F Bathythermograph	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	Low	See Item #46
49	Water temperature	Area 3					CCS	No	N/A	CSS\2004 Bathy					UNCLASS	Nil	High	
			Unk	Unk	Unk		Bathy	No	N/A	MK8F Bathythermograph	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	Low	See Item #46
50	Thermoclines	Area 3					CCS	No	N/A	CCS UNICAST - Bathy Message	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	UNCLASS	Nil	High	See Item #46
			Unk	Unk	Unk		Bathy	No	N/A	MK8F Bathythermograph	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	UNCLASS	Nil	Low	See Item #46
51	Bottom contours	Area 3, Area 4	N/A	Unk	Unk	Uses Lat/Long/Depth from ECPINS	A Priori	No	N/A	Download Data into IID	Unk	Unk	N/A	N/A	UNCLASS	Nil	N/A	
52	Bottom type	Area 3	N/A	Unk	Unk		A Priori	No	N/A	Download Data into IID	As Required	As Required	N/A	N/A	UNCLASS	Nil	N/A	
53	Underwater obstacles/hazards	Area 3	N/A	Unk	Unk		A Priori	No	N/A	Download Data into IID	Unk	Unk	N/A	N/A	UNCLASS	Nil	N/A	
	~~Best depth for covertness~~	Area 3				Recommend changing terminology covertness to best evasion depth. The term "covertness" is too general in that it could also be used for mast states when doing specail forces ops or a photo recognizance. Best evasion and listening depths, although completely different, could both be used in area 8 tactical picture in place of "covertness" depending upon whether it is the submarine wanting to detect in order to attack a transiting task force with a HV unit or if it is a submarine trying to avoid detection from an attacking force.												
54	Best Evasion Depth	Area 3	Meters	Unk	Unk	New, replaces "Best depth for covertness" in Area 3.	Command Input	No	N/A	Manual Input from Sound Room	As Required	As Required	Meters	0.1	CLASS	Nil	N/A	The Best Evasion Depth is determined by the SVP and the resulting Ray Traces.
55	Best Listening Depth	-	Meters	Unk	Unk	New, not applicable to Area 3. Is it used anywhere in IID?	Command Input	No	N/A	Manual Input from Sound Room	As Required	As Required	Meters	0.1	CLASS	Nil	N/A	The Best Listening Depth is determined by the SVP and the resulting Ray Traces.
56	Tidal charts / information	Area 3, Area 4, Area 5-Rel Brg	Unk	Unk	Unk	May need to clarify what specific tidal information is needed.	A Priori	No	N/A	Download Reference to IID	Unk	Unk	Unk	Unk	UNCLASS	Nil	N/A	
57	Uncertainty of bottom contours, location and range of critical features	Area 3	Unk	Unk	Unk	This is the uncertainty of depth measurement at a designated contour position (not the uncertainty in contour position for a designated depth). These will likely be based on estimates provided on the source contour plots.	A Priori	No	N/A	Download Data into IID	Unk	Unk	Unk	Unk	UNCLASS	Nil	N/A	The Data is would be located on the charts.
58	Acoustic sea state	Area 3	N/A	Unk	Unk		Command Input	No	N/A	Download Data into IID	As Required	As Required	N/A	N/A	UNCLASS	Nil	N/A	The Acoustic Sea State will be affected by the weather conditions, depth of water, shipping in area, distance from shore and biological. The range prediction software will provide the Acoustic Sea State along with Senior Sonar Operator judgemental input.
59	Time of next BATHY firing	Area 3, Area 6	Time (Hrs)	Unk	Unk	Area 6 information is time "to", but will still need time of next firing to compute this.	Command Input	No	N/A	Manually Input or Fixed from 4 - 6 hours from previous BATHY firing	As Required	As Required	Hour, Min, Sec	Seconds	CLASS	Nil	N/A	
60	Bathy data	Area 3				New, as per Virtual VIC Data Model. Assume this is data from MK8-F Bathy laptop (e.g., .edf files).	CCS	Yes	N/A	CCS UNICAST - Bathy Message	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	High	The Sound Velocity Profile is transmitted via UNICAST to a determined IP address. The subtype is a 16-bit unsigned integer equal to BATHY_MSGID(1906). This transmission will include the time stamp for when the message was recorded, Lat/Long of when data was obtained, filename, probe type and the terminal depth. Note: Bathy profiles are currently entered into CCS manually, but will be transmitted to CCS via MK8F Bathythermograph upon EC completion.
			Unk	Unk	Unk		Bathy	No	N/A	MK8F Bathythermograph	When New Data Received	When New Data Received	Depth = Feet SV = Feet/Sec	1	CLASS	Nil	Low	The Bathy connection is not currently connected onboard. The MK8F Bathythermograph transmits via Serial Binary modes and Serial ASCII modes. The Serial Binary modes are based on NTDS protocol.

	Properties of Information for IID						Properties of Required IID Information in the Submarine System(s) in Which It Is Available											
No.	IID Info Definition	IID Display Ref (Area)	Units	Resolution	Allowed Staleness	Comment	Submarine System	Publish/ Subscribe Done	Transmission Format	Potential Method(s) to Transfer Info to IID	Time Between Data Refresh Within System	Update Rate of Info Sent From System	Units	Resolution	Security Designation	Constraints	Prioritization of Multiple Systems	Comment
61	Ownship position	Area 4, Area 2	Decimal Degrees	0.0001	Fast	Plot of Lat/Long	CCS	No	N/A	CCS UNICAST - Ownship Message	Seconds	Seconds	Decimal Degrees	0.00001	CLASS	Nil	High	The OwnshipPosition is transmitted via UNICAST to a determined IP address. This data would be available in the Ownship Message which identifies the "Latitude and Longtitude" within a 32-bit floating point number.
							NDDS	Yes	NMEA-0183 using 100 Base-T Ethernet Standard data.	Primary Method: CCS Ethernet Switch (A1A5) located on the back of CCS Consoles. Secondary Method: Retrieve data from LAN1 Ethernet Switch located next to SDM.	Seconds	Seconds	Decimal Degrees	0.00001	CLASS	Nil	Low	Ownship Postion is supplie to the LAN1 Switch and CCS 876 via RJ45 Ethernet at 100 MB/sec. The Lat/Long is available at either location.
62	Ownship course to steer	Area 4	Degrees	1	Unk		Command Input	No	N/A	Manual Input	As Required	As Required	Degrees	0.1	CLASS	Nil	N/A	
63	Ownship position: Verification points of path	Area 4	Decimal Degrees	0.0001	Unk	Confirmed points from periscope or GPS. Require Periscope bearing cuts and Lat/Long position (and ID) of reference points to compute the actual OS position fix.	SDM	No	N/A	Manual Input	Unk	Unk	Unk	Unk	CLASS	Nil	N/A	
64	Periscope cuts		Decimal Degrees	Unk	Unk	New. Record periscope cuts used in position fix.	CCS	No	N/A	CCS UNICAST - Periscope Message	Between Transmission of Perisope Bearing Cuts	After the CCS BIU has received a Perisocpe Message and converted it into the UNICAST format.	Degrees	0.0001	CLASS	Nil	N/A	The Persicope Cuts can be identified via UNICAST in the Perisocpe Message. This is valid for both Search and Attack Perisocpes.
65	Lat/Long position of reference points.		Decimal Degrees	0.0001	Unk	New.	A Priori	No	N/A	Manual Input	Unk	Unk	Unk	Unk	UNCLASS	Nil	N/A	
66	Ownship ~~bearing~~ course w.r.t. Ground	Area 4	Degrees	1	Fast	IID Design Doc shows source from boat's Gyro. Assume this should be "course" rather than "bearing".	CCS	No	N/A	CCS UNICAST - Ownship Message	Seconds	Seconds	Radians	0.001	CLASS	Nil	High	The Ownship Course is transmitted via UNICAST to a determined IP address. This data would be available in the Ownship Message which identifies the "Heading" within a 32-bit floating number.
							NDDS	Yes	NMEA-0183 using 100 Base-T Ethernet Standard data.	Primary Method: CCS Ethernet Switch (A1A5) located on the back of CCS Consoles. Secondary Method: Retrieve data from LAN1 Ethernet Switch located next to SDM.	Seconds	Seconds	Degrees	0.001	CLASS	Nil	Low	Ownship Course is supplied to the LAN1 Switch and CCS 876 via RJ45 Ethernet at 100 MB/sec. The course is available at either location.
67	Ownship Speed w.r.t. Ground	Area 4	Knots	0.1	Fast	Confirm IID requires OS speed w.r.t. ground.	CCS	No	N/A	CCS UNICAST - Ownship Message	Seconds	Seconds	Yards/Second	0.001	CLASS	Nil	High	The Ownship Speed is transmitted via UNICAST to a determined IP address. This data would be available in the Ownship Message which identifies the "Speed" within a 32-bit floating point number.
							NDDS	Yes	NMEA-0183 using 100 Base-T Ethernet Standard data.	Primary Method: CCS Ethernet Switch (A1A5) located on the back of CCS Consoles. Secondary Method: Retrieve data from LAN1 Ethernet Switch located next to SDM.	Seconds	Seconds	Knots	0.001	CLASS	Nil	Low	Ownship Postion is supplie to the LAN1 Switch and CCS 876 via RJ45 Ethernet at 100 MB/sec. The Speed is available at either location.
68	Planned route w.r.t. Ground	Area 4	Degrees	1	Unk	Specified as Lat/Long. Includes ETA to navigation points (as per Area 6). Course and speed data are implicitly w.r.t. Ground.	SDM	No	N/A	Extract Data Electronically from SDM	Unk	Unk	Unk	Unk	CLASS	Nil	N/A	Requires major software EC to SDM to extract data from SDM. The workaround would be to manually extract the data.
69	Contact/COI Position	Area 4	Decimal Degrees	0.0001	Unk		CCS	No	N/A	CCS UNICAST - Ownship and Threat Messages	Seconds	Seconds	Decimal Degrees	0.0001	UNCLASS	Nil	N/A	The CCS UNICAST Ownship and Threat Messages can be used to determine the COI Position. This can be done by utilizing the Ownship Position and the Bearing/Range of the Contact wrt the ownship.
70	Contact/COI Course w.r.t. Ground	Area 4	Degrees	1	Unk	New. Assume the Contact/COI course and speed will also be part of the Area 4 plot (integrated with the speed "vector" that is usually part of thet NATO symbology). In Area 4, this will be course and speed w.r.t. Ground.	CCS	No	N/A	CCS UNICAST - Threat Message	Every 6 Seconds	Minute	Radians	0.001	CLASS	Nil	N/A	The Contact/COI Course is transmitted via UNICAST to a determined IP address.. This data would be available in the Threat Message identified as "Course" using a 64-bit floating point number with the Unit of Radians.
71	Contact/COI Speed w.r.t. Ground	Area 4	Knots	0.1	Unk	New. See comment in preceding item.	CCS	No	N/A	CCS UNICAST - Threat Message	Every 6 Seconds	Minute	Yds/Sec	0.001	CLASS	Nil	N/A	The Contact/COI Speed is transmitted via UNICAST to a determined IP address.. This data would be available in the Threat Message identified as "Speed" using a 64-bit floating point number with the Unit of yards per second.
72	Contact/COI track history	Area 4	Decimal Degrees	Unk	Unk	Presumably Area 4 (Contact/COI Position) will be used to build track history internally to IID, i.e., source of history data likely will not be external to IID. Area 4 history track data will be w.r.t. Ground.	IID History Database	No	N/A	Historical Record of CCS UNICAST data sent to IID	Unk	Unk	Unk	Unk	CLASS	Nil	N/A	The CCS UNICAST Threat Message Data will provide a continuous feed for the IID to utilize or store. As this data is received and stored in the IID, it can be used to provide a historical perspective.
	Contact/COI ~~classification~~ Allegiance, Category	Area 4, Area 3, Area 5-Rel Rng, Area 5-Rel Brg, Area 8-Contact Mgt																
	Track numbers	Area 4, Area 3, Area 5-Brg Rate, Area 8-Contact Mgt, Area 8-Weapons				IID Design Doc specifies source from ECPINS, but likely will be taken from SFCS.												
73	Location of land	Area 4	Unk	Unk	Unk		A Priori	No	N/A	Download Data into IID	Unk	Unk	Unk	Unk	UNCLASS	Nil	N/A	
74	Go/no-go zones	Area 4	Unk	Unk	Unk		A Priori	No	N/A	Download Data into IID	Unk	Unk	Unk	Unk	UNCLASS	Nil	N/A	
	Bottom contours	Area 4, Area 3				Uses Lat/Long/Depth from ECPINS												
75	Uncertainty about contact/COI Position	Area 4	Nautical Miles	0.1	Unk	Implies info comes from sensor. Use elipse of uncertainty for position error.	CCS	No	N/A	CCS UNICAST - Threat Message	Minute	Minute	Multiple: Yards, Radians, Yards/Sec	0.001	CLASS	Nil	N/A	
76	Contact/COI counterdetection ranges	Area 4, Area 5-Rel Rng, Area 5-Rel Brg, Area 8-COI	Unk	0.1	Unk		Command Input	No	N/A	Manual Input from Sound Room	As Required	As Required	Yards	100	CLASS	Nil	N/A	The COI Counterdetection Ranges will depend upon the SVP and type of COI (ie. Warship, Helo, Aurora, Fixed Wing Aircraft). The type of vessel abilities will affect the counterdetection ranges.
77	Contact/COI weapons ranges and type of weapon	Area 4, Area 5-Rel Rng, Area 5-Rel Brg, Area 5-Brg Rate, Area 8-COI	Nautical Miles	0.1	Unk		A Priori	No	N/A	Download Data into IID	As Required	As Required	Yards	100	CLASS	Nil	N/A	This information will be determined by the inputed reference material such as Janes Fighting Ships.

			Properties of Information for IID				Properties of Required IID Information in the Submarine System(s) in Which It Is Available											
No.	IID Info Definition	IID Display Ref (Area)	Units	Resolution	Allowed Staleness	Comment	Submarine System	Publish/ Subscribe Done	Transmission Format	Potential Method(s) to Transfer Info to IID	Time Between Data Refresh Within System	Update Rate of Info Sent From System	Units	Resolution	Security Designation	Constraints	Prioritization of Multiple Systems	Comment
78	Currents	Area 4, Area 5-Rel Brg (Tidal charts/info & currents)	Knots	Unk	Unk		A Priori	No	N/A	Download Data into IID	Unk	Unk	Unk	Unk	UNCLASS	Nil	N/A	
	Tidal charts/ information	Area 4, Area 3, Area 5-Rel Brg																
79	Tidal charts / information: Date of tide information	Area 4	DTS	Unk	Unk		A Priori	No	N/A	Download Data into IID	Unk	Unk	Date	N/A	UNCLASS	Nil	N/A	
80	Time/Date when an area has been surveyed from charts: Date of chart	Area 4	Unk	Unk	Unk		A Priori	No	N/A	Download Data into IID	Unk	Unk	Time/Date Units	N/A	UNCLASS	Nil	N/A	
81	Tactical priorities: Trip wires	Area 4	N/A	N/A	Unk		Command Input	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	The Trip Wires will be determined by the CO.
82	Traffic lanes: separation schemes (TSS)	Area 4	N/A	Unk	Unk		A Priori	No	N/A	Download Data into IID	Unk	Unk	N/A	N/A	UNCLASS	Nil	N/A	
83	Contact track projection	Area 4	Decimal Degrees, Time	.0001 Seconds	Unk	New. Projected track, as suggested by Virtual VIC Data Model, but not clear if actually used in IID.	CCS	No	N/A	CCS UNICAST - Threat Message	Minute	Minute	Multiple: Yards, Radians, Yards/Sec	0.001	CLASS	Nil	N/A	Plot contact range and bearing from submarines position. This information would be plotted on a chart in the IID. The uncertainty would be created by the range provided by CCS.
84	Contact altitude	Area 4	Feet	1	Unk	New. Altitude of contact, as suggested by Virtual VIC Data Model, but not clear if actually used in IID.	None	No	N/A	See Comment	N/A	N/A	Meters	0.1	CLASS	Nil	N/A	Altitude is not measured or received by submarine systems. At best, a manual altude estimate would be made.
85	Ownship position	Area 5 - Rel Rng	Decimal Degrees	0.0001	Fast	No data needed - this is the fixed centre of the plot.	CCS	No	N/A	CCS UNICAST - Ownship Message	Seconds	Seconds	Degrees	0.00001	CLASS	Nil	N/A	See Item #31.
86	Battery Endurance (planned)	Area 5 - Rel Rng	Hours	0.1	Slow		Manual Data Collection	No	N/A	Manual Input	N/A	As directed by Comd, battery dips as required by operational situation.	Percentage	1	UNCLASS	Nil	N/A	In order to produce the estimate in hours needed by the IID, will need an estimate for battery capacity. The Battery Endurance (Planned) will be calculated by the IID.
87	Battery Endurance (current)	Area 5 - Rel Rng, Area 2	Hours	0.1	Slow		Manual Data Collection	No	N/A	Manual Input	N/A	As directed by Comd, battery dips as required by operational situation.	Percentage	1	UNCLASS	Nil	N/A	In order to produce the estimate in hours needed by the IID, will need an estimate for battery capacity.
88	Ownship signature profile: Range of most detectable signature (strongest signature)	Area 5 - Rel Rng, Area 5-Rel Brg	Nautical Miles	1	Unk	We need to identify multiple potential signature profiles that are dependent on situation (e.g., dived, snorting, firing, etc.), and identify how the 'situation'is to be specified to select the profile? Look at recommendations for better measurement/prediciton of self-noise for VCS.	Command Input	No	N/A	Manual Input from Sound Room	As Required	As Required	Yards	100	CLASS	Nil	N/A	The Range of most Dectectable Signature is dependant upon the submarines LOFAR signature that can be detected at extended ranges if the COI has a LOFAR capability.
89	Closest acceptable distance	Area 5 - Rel Rng, Area 5 - Rel Brg	Nautical Miles	0.1	Unk		Command Input	No	N/A	Manual Input	As Required	As Required	Yards	100	CLASS	Nil	N/A	
90	Depth bracket	Area 5 - Rel Rng	Meters	1	Unk	Seems to be different from Area 2. Area 2 is a display of submarines present depth. Area 5 appears to be ECPINS obtained and is displayed more as a safe navigation aid and may assist in littoral ops as boundry idendtifiers.	Command Input	No	N/A	Manual Input	As Required	As Required	Meters	0.1	CLASS	Nil	N/A	
	Contact/COI counterdetection range	Area 5 - Rel Rng, Area 4, Area 5-Rel Brg, Area 8-COI																
91	Contact/COI weapons range and type of weapon	Area 5 - Rel Rng, Area 4, Area 5-Rel Brg, Area 5-Brg Rate, Area 8-COI	Nautical Miles	0.1	Unk		Reference Library	No	N/A	Manual Input	As Required	As Required	Yards	0.1	CLASS	Nil	N/A	
	Contact/COI classification	Area 5 - Rel Rng, Area 4																
92	Uncertainty of current contact/COI range	Area 5 - Rel Rng, Area 5-Rel Brg	Nautical Miles	0.1	Unk	Assume this is the uncertainty in the contact/COI range determined from sensor data/TMA.	CCS	No	N/A	CCS UNICAST - Threat Message	Minute	Minute	Yards	0.001	CLASS	Nil	N/A	The Uncertainty of current contact/COI Range is transmitted via UNICAST to a determined IP address.. This data would be available in the Threat Message identified as "Range Error" using a 32-bit floating point number with the Unit of yards.
93	Contact/COI ~~relative~~ true bearing	Area 5 - Rel Rng, Area 5-Rel Brg, Area 5-Brg Rate	Degrees	0.1	Unk	Note that IID is using a "relative" bearing plot, but the bearing info it uses is normally referred to as "true bearing", i.e., bearing w.r.t. true North.	CCS	No	N/A	CCS UNICAST - Threat Message	Every 6 Seconds	Minute	Radians	0.001	CLASS	Nil	N/A	The Contact/COI True Bearing is transmitted via UNICAST to a determined IP address.. This data would be available in the Threat Message identified as "Bearing" using a 64-bit floating point number with the Unit of radians. This data is also available in the TMA Message and identified as "Bearing" uilitizing a 32-bit foating number.
94	Contact/COI range estimate	Area 5 - Rel Rng, Area 5-Rel Brg, Area 8-Weapons	Nautical Miles	0.1	Unk	Separate from related info type in Area 3 (COI predicted range).	CCS	No	N/A	CCS UNICAST - Threat Message	Minute	Minute	Yards	0.001	CLASS	Nil	N/A	The Contact/COI True Range Estimate is transmitted via UNICAST to a determined IP address.. This data would be available in the Threat Message identified as "Range" using a 64-bit floating point number with the Unit of yards. This data is also available in the TMA Message and identified as "Range" uilitizing a 32-bit foating number.
	Contact/COI range estimate: Historical	Area 5 - Rel Rng, Area 5-Brg Rate				Source specified as ECPINS in Design Doc (likely not appropriate, since historical data should be the same source as range estimate data above, which was SFCS). Historical data will likely be taken as an accumulation of "current" range estimate data, so will not be a separate information type (i.e., requiring a different source, e.g., history database).												
95	Closest point of approach (CPA): Predicted	Area 5 - Rel Rng, Area 5-Rel Brg	Nautical Miles	0.1	Unk		CCS	No	N/A	CCS UNICAST - Multiple Messages	Various	Various	Nautical Miles	0.1	CLASS	Nil	N/A	The Closest Point of Approach(CPA) is calculated by UNICAST data.
96	Time to CPA	Area 5 - Rel Rng, Area 5 - Rel Brg	Seconds	1	Unk		CCS	No	N/A	CCS UNICAST - Multiple Messages	Various	Various	Seconds	1	CLASS	Nil	N/A	The Closest Point of Approach(CPA) is calculated by UNICAST data.

No.	IID Info Definition	IID Display Ref (Area)	Properties of Information for IID: Units	Resolution	Allowed Staleness	Comment	Properties of Required IID Information in the Submarine System(s) in Which It Is Available: Submarine System	Publish/ Subscribe Done	Transmission Format	Potential Method(s) to Transfer Info to IID	Time Between Data Refresh Within System	Update Rate of Info Sent From System	Units	Resolution	Security Designation	Constraints	Prioritization of Multiple Systems	Comment
97	Previous Sensor fixes	Area 5 - Rel Rng	Unk	Unk	Unk	Should be referred to Contact Sensor TMA History	IID History Database	No	N/A	CCS UNICAST Sensor Messages	Minute	Minute	Multiple: Yards, Radians, Yards/Sec	0.001	CLASS	Nil	N/A	The IID would read and process the CCS Sensor Messages to determine the previous sensor fixes.
	Contact/COI symbol: classification (Allegiance, Category, Platform)	Area 5 - Rel Rng, Area 4, Area 3, Area 5-Rel Brg, Area 8-Contact Mgt				New. IID Design document shows the Area 5 Range view has NATO symbology for the contact/COI, which will require classification data to choose appropriate symbol.												
	Contact/COI symbol: contact/COI course w.r.t. water mass, contact/COI speed w.r.t. water mass	Area 5 - Rel Rng, Area 5-Brg Rate, Area 5-Rel Brg				New. IID Design document shows the Area 5 Range view has a velocity vector as part of the contact/COI symbol, which will require contact/COI course & speed (w.r.t. water mass) info.												
	OS symbol: OS course w.r.t. water mass, OS speed w.r.t. water mass	Area 5 - Rel Rng, Area 2, Area 5-Rel Brg				New. IID Design document shows the Area 5 Range view has a velocity vector as part of the OS symbol, which will require OS course & speed (w.r.t. water mass) info.												
98	Ownship position	Area 5 - Rel Brg	Decimal Degrees	0.0001	Fast	Described as being the centre of the plot which did not seem to be a geographic plot (therefore no data should be needed), but Design Doc indicated that it uses Lat/Long from ECPINS?	CCS	No	N/A	CCS UNICAST - Ownship Message	Seconds	Seconds	Decimal Degrees	0.00001	CLASS	Nil	N/A	See Item #31.
	Ownship ~~bearing~~ course w.r.t. Water Mass	Area 5 - Rel Brg, Area 2				Confirm "bearing" should be "course". Assume Course is w.r.t. Water Mass.												
	Contacts/COI ~~relative~~ true bearing	Area 5 - Rel Brg, Area 5-Rel Rng				IID Design Doc has source specified as Sonar. We will assume can be interchanged with SFCS. See comment about "relative" bearing in Area 5 - Rel Rng (Contact/COI relative bearing).												
99	Contact/COI bearing rate	Area 5 - Rel Brg, Area 5-Brg Rate	Degrees/Min	0.1	Unk		CCS	No	N/A	CCS UNICAST - Threat Message	Minute	Minute	Radians/Sec	0.001	CLASS	Nil	N/A	The Contact bearing rate is transmitted via UNICAST to a determined IP address. This data would be available in the Threat Message identified as"Bearing Rate" using a 64-bit double floating point number.
	Contacts/COI range estimate	Area 5 - Rel Brg, Area 5-Rel Rng, Area 8-Weapons																
	Uncertainty of contact/COI range	Area 5 - Rel Brg, Area 3																
	Closest acceptable distance	Area 5 - Rel Brg, Area 5 - Rel Rng				What is "TOTES" laptop?												
100	Raw broadband signal	Area 5 - Rel Brg	N/A	Unk	Unk		Manual Data Collection	No	N/A	Manual Input from Sound Room	Unk	Unk	N/A	N/A	CLASS	Nil	N/A	Direct Path range prediction from the sound room for each sonar system.
101	Optimum manoeuvre for ranging (e.g., stern arcs procedures)	Area 5 - Rel Brg	Unk	Unk	Unk	Range of stern arc available from Stern Arc Operating Procedures (STOPS).	Command Input	No	N/A	Manual Input	As Required	As Required	Degrees	0.1	CLASS	Nil	N/A	
102	Ownship detection range: Sensor ranges	Area 5 - Rel Brg Area 3	Nautical Miles	Unk	Unk		Command Input	No	N/A	Manual Input from Sound Room	As Required	As Required	Yards	0.1	CLASS	Nil	N/A	
103	Ownship optimum manoeuvring: Acquiring TMA	Area 5 - Rel Brg	Unk	Unk	Unk		CCS	No	N/A	CCS UNICAST - Threat Message CCS UNICAST - Ownship Message	Minute Second	Minute Second	Radians/Knots	0.001	CLASS	Nil	N/A	The IID would receive Ownship Course and Speed via CCS UNICAST and Target Course and Speed via CCS UNICAST. The IID would be required to take this information and calculate the maximum OSA and best course to steer to achieve maximum change in Bearing Rate.
104	Contact/COI ~~relative~~ true bearing: Radar data	Area 5 - Rel Brg	Degrees	0.1	Unk	Normally uses "true", not "relative" bearing (even in a relative plot).	CCS	No	N/A	CCS UNICAST - Radar Annotation Message	When New Data Received	When New Data Received	Degrees	0.1	CLASS	Nil	N/A	The Contact bearing:Radar Data is transmitted via UNICAST to a determined IP address. This data would be available in the Radar Annotation Message identified as"Bearing" using a 16-bit signed integer.
105	Contact/COI ~~relative~~ true bearing: ESM	Area 5 - Rel Brg	Degrees	0.1	Unk	Normally uses "true", not "relative" bearing (even in a relative plot).	CCS	No	N/A	CCS UNICAST - Threat and ESM Message	When New Data Received	When New Data Received	Radians or degrees	0.001	CLASS	Nil	N/A	The Contact true bearing is transmitted via UNICAST to a determined IP address. This data would be available in the Threat Message identified as"Bearing" using a 64-bit double floating point number. This data is also available in the ESM Message identified as "Bearing" using a 9-bit unsigned integerthat gives the bearing measurement of the Emitter in degrees.
	Contact/COI weapons ranges and type of weapon	Area 5 - Rel Brg, Area 4, Area 5-Rel Rng, Area 5-Brg Rate, Area 8-COI																
	Contact/COI counterdetection ranges	Area 5 - Rel Brg, Area 4, Area 5-Rel Rng, Area 8-COI																
	Ownship signature profile: Range of most detectable signature (strongest signature)	Area 5 - Rel Brg, Area 5-Rel Rng																
	Tidal charts/ information and currents	Area 5 - Rel Brg, Area 4, Area 3 (tidal chart)																
	CPA	Area 5 - Rel Brg, Area 5 - Rel Rng																
106	COI change (how / when) behaviour (suspicious)	Area 5 - Rel Brg, Area 5-Brg Rate (Contact/COI recent behaviour)	N/A	Unk	Unk		None	No	N/A	See Comment	Minute	Minute	N/A	N/A	CLASS	Nil	N/A	The COI behavior changes are not determined by a specific submarine system.
	Contact/COI symbol: classification (Allegiance, Category, Platform)	Area 5 - Rel Brg, Area 3, Area 4, Area 5-Rel Rng, Area 8-Contact Mgt				New. IID Design document shows the Area 5 Bearing view has NATO symbology for the contact/COI, which will require classification data to choose appropriate symbol.												

	Properties of Information for IID							Properties of Required IID Information in the Submarine System(s) in Which It Is Available											
No.	IID Info Definition	IID Display Ref (Area)	Units	Resolution	Allowed Staleness	Comment	Submarine System	Publish/ Subscribe Done	Transmission Format	Potential Method(s) to Transfer Info to IID	Time Between Data Refresh Within System	Update Rate of Info Sent From System	Units	Resolution	Security Designation	Constraints	Prioritization of Multiple Systems	Comment
	Contact/COI symbol: contact/COI course w.r.t. water mass, contact/COI speed w.r.t. water mass	Area 5 - Rel Brg, Area 5-Brg Rate, Area 5-Rel Rng				New. IID Design document shows the Area 5 Bearing view has a velocity vector as part of the contact/COI symbol, which will require contact/COI course & speed (w.r.t. water mass) info.												
	OS symbol: OS course w.r.t. water mass, OS speed w.r.t. water mass	Area 5 - Rel Brg, Area 2, Area 5-Rel Rng				New. IID Design document shows the Area 5 Bearing view has a velocity vector as part of the OS symbol, which will require OS course & speed (w.r.t. water mass) info.												
107	Periscope Imagery: Imagery [FUTURE: Video is expected to become available]	Area 5 - Periview, [Area 5-Periview (Periscope Imagery: Recent and historical imagery)]	N/A	Unk	Unk	Presumably historical imagery will just record these imagery views.	TTVC	No	N/A	Video feed from TTVC.	N/A	N/A	N/A	Unk	CLASS	Nil	N/A	The video feed can be retrieved via the current TTVC.
108	Periscope imagery: Periscope type	Area 5 - Periview	N/A	Position (State)	Unk		Unk	Unk	Unk	See Comment	Unk	Unk	N/A	N/A	CLASS	Nil	N/A	The Attack Periscope provides a video feed. The Search Periscope does not currently have a video feed.
109	Direction of periscope	Area 5 - Periview	Degrees	0.1	Unk		CCS	No	N/A	CCS UNICAST - Periscope Message	When New Data Received	When New Data Received	Radians	0.001	CLASS	Nil	N/A	The Direction the Periscope is transmitted via UNICAST to a determined IP address. This data would be available in the Periscope Message identified as"SP Bearing" and "AP Bearing" using a 32-bit double floating point number. This message is transmitted after the BIU has received a Periscope Message and has converted .
	Periscope imagery: Recent and historical imagery	Area 5 - Periview, [Area 5-Periview (Periscope Imagery: Imagery)]				Presumably historical imagery is just a record of "current" imagery views, so it is just a matter of the database to store, not the source of data.												
	Track numbers	Area 5 - Brg Rate, Area 3, Area 8-Contact Mgt, Area 8-Weapons																
	COIs listed in mission documentation	Area 5 - Brg Rate, Area 8-COI																
	Contact/COI true bearing	Area 5 - Brg Rate, Area 5-Rel Rng, Area 5-Rel Brg																
110	COI ~~true~~ relative bearing	Area 5 - Brg Rate	Degrees	0.1	Unk	Assume this is intended to be just "relative bearing".	CCS	No	N/A	CCS UNICAST - Threat Message	Minute	Minute	Radians	0.001	CLASS	Nil	N/A	By utilizing CCS UNICAST to get COI True Bearing, the IID can determine the relativve bearing.
	Contact/COI bearing rate	Area 5 - Brg Rate, Area 5-Rel Brg																
111	Contact/COI predicted course w.r.t. Water Mass	Area 5 - Brg Rate, Area 8-Weapons (COI current course)	Degrees	0.1	Unk	Confirm this is course w.r.t. Water Mass	CCS	No	N/A	CCS UNICAST - Threat Message	Minute	Minute	Radians	0.001	CLASS	Nil	N/A	The Contact Predicted Course is transmitted via UNICAST to a determined IP address. This data would be available in the Threat Message identified as"Course" using a 63-bit double floating point number. The CCS UNICAST will provide threat data w.r.t. ground. It will not take into account such things as current.
112	Contact/COI speed w.r.t. Water Mass	Area 5 - Brg Rate, Area 8-Weapons	Knots	0.1	Unk	Confirm this is COI speed w.r.t Water Mass.	CCS	No	N/A	CCS UNICAST - Threat Message	Minute	Minute	Yds/Sec	0.001	CLASS	Nil	N/A	The Contact Speed is transmitted via UNICAST to a determined IP address. This data would be available in the Threat Message identified as"Speed" using a 63-bit double floating point number. The CCS UNICAST will provide threat data w.r.t. ground. It will not take into account such things as current.
	Contact/COI weapons ranges and type of weapon	Area 5 - Brg Rate, Area 4, Area 5-Rel Rng, Area 5-Rel Brg, Area 8-COI																
113	Contact/COI track history	Area 5 - Brg Rate, Area 5-Rel Rng, Area 5-Rel Brg	Various	Various	Unk	Contact/COI track history will likely just be an IID database of reported contact/COI track data (e.g., TMA data), so no new source is involved, i.e., we do not expect to get history data externally to IID. History track data in Area 5 is w.r.t. Water Mass.	IID History Database	No	N/A	Historical Record of CCS UNICAST data sent to IID	Various	Various	Various	Various	CLASS	Nil	N/A	The CCS UNICAST Threat Message Data will provide a continuous feed for the IID to utilize or store. As this data is received and stored in the IID, it can be used to provide a historical perspective.
114	Contact/COI recent behaviour	Area 5 - Brg Rate, Area 5-Rel Brg (COI change (how/when) behaviour (suspicious))	N/A	Unk	Unk		None	No	N/A	See Comment	Minute	Minute	N/A	N/A	CLASS	Nil	N/A	The COI behavior changes are not determined by a specific submarine system.
115	Threat level associated with COI	Area 5 - Brg Rate	Position (State)	N/A	Unk		CCS/Command Input	No	N/A	CCS UNICAST - Multiple Messages	Various	Various	Various	Various	CLASS	Nil	N/A	Only whether or not a contact appears on the CCS Threat Tote can be obtained from CCS UNICAST. No relative ranking of threats is done within submarine systems, other than by Command Input.
116	Likely contacts	Area 5 - Brg Rate	N/A	N/A	Unk		Command Input	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	The likely contacts would be obtained from the Brainstorm message and this data would be entered by the CO. The likely contacts could be determined by the area of operation such as shipping lanes or fishing grounds.
117	Potential threats / Type of threat	Area 5 - Brg Rate	N/A	N/A	Unk		CCS/Command Input	No	N/A	CCS UNICAST - Multiple Messages	Various	Various	Various	Various	CLASS	Nil	N/A	Only whether or not a contact appears on the CCS Threat Tote can be obtained from CCS UNICAST. No relative ranking of threats is done within submarine systems, other than by Command Input.

No.	IID Info Definition	IID Display Ref (Area)	Properties of Information for IID: Units	Resolution	Allowed Staleness	Comment	Properties of Required IID Information in the Submarine System(s) in Which It Is Available: Submarine System	Publish/ Subscribe Done	Transmission Format	Potential Method(s) to Transfer Info to IID	Time Between Data Refresh Within System	Update Rate of Info Sent From System	Units	Resolution	Security Designation	Constraints	Prioritization of Multiple Systems	Comment
118	Uncertainty of Contact/COI current bearing	Area 5 - Brg Rate	Decimal Degrees	0.1	Unk	It is called uncertainty in "bearing", but the description refers to it as "course".	CCS	No	N/A	CCS UNICAST - Threat Message	Minute	Minute	Radians	0.0001	CLASS	Nil	N/A	TheContact uncertainty is transmitted via UNICAST to a determined IP address. This data would be available in the Threat Message identified as "Bearing Error" using a 32-bit floating point number.
119	Sonar (waterfall) display	Area 5	N/A	Unk	Unk	What sonars are displayed (only Bow Sonar, or PRS, Flank, etc.)? Only waterfall display? Only one display per sonar? Video or digital feed? If video feed, will it include the whole sonar display, including any menus, as opposed to just the waterfall display? In addition, is it possible the video feed could be shifted away from a waterfall display?	Sonars	No	N/A	Video feed from PRS\BSSU\2046	N/A	N/A	N/A	N/A	CLASS	Nil	N/A	Direct Video feed from PRS/BSSU/2046.
120	Time of next broadcast routine	Area 6	Unk	Unk	Unk		Command Input	No	N/A	Manual Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
	ETA at critical navigation points	Area 6, Area 4				Extracted from Area 4 planned route.												
121	Planned route/nav plans	Area 6	Degrees	Unk	Unk	Changes in course w.r.t. Ground, and depth.	Planning Input	No	N/A	Command Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
122	Why we need to be at particular locations	Area 6	Unk	Unk	Unk		Planning Input	No	N/A	Command Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
123	Orders from higher command	Area 6	Unk	Unk	Unk		Planning Input	No	N/A	Command Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
124	Mission orders	Area 6	Unk	Unk	Unk		Planning Input	No	N/A	Command Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
125	Comms plan	Area 6	Unk	Unk	Unk		Planning Input	No	N/A	Command Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
126	Navigation priorities	Area 6	Unk	Unk	Unk		Planning Input	No	N/A	Command Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
127	Tactical priorities	Area 6	Unk	Unk	Unk		Planning Input	No	N/A	Command Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
128	Best opportunity to transmit VISINT data via SUBIP	Area 6	Unk	Unk	Unk		Planning Input	No	N/A	Command Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
129	Current task	Area 6	Unk	Unk	Unk		Planning Input	No	N/A	Command Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
130	Tactical plan	Area 6	Unk	Unk	Unk		Planning Input	No	N/A	Command Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
131	When to snort	Area 6	Unk	Unk	Unk	Likely taken from same source as "Details of snorting plan".	Planning Input	No	N/A	Command Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
132	Details of snorting plan	Area 6	Unk	Unk	Unk	Likely taken from same source as "When to snort".	Planning Input	No	N/A	Command Input	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
	Time to next BATHY firing	Area 6, Area 3				Area 3 "Time of next BATHY firing" will be needed to compute this value.												
	Air Quality	Area 7, Area 2																
133	Weapons state	Area 7, Area 8	N/A	Unk	Unk	Specifies whether or not the weapon is armed. May need to clarify what exactly is meant by "armed" (e.g., Safe/Fire key set to Fire?).	CCS	No	N/A	CCS UNICAST - MK48 Mod4 Telcom Message	0.25 Seconds	0.25 Seconds	N/A	N/A	CLASS	Nil	N/A	The Weapon state is transmitted via UNICAST to a determined IP address. This data would be available in the MK48 Mod4 Telcom Message identified as "Exploder Armed" using a 32-bit flag representing True or False.
	Depth of water	Area 7, Area 3				Charted Depth is compared to a depth warning value. Also need to specify the warning depth. This is refers to Priority 1 and 2 alarms, and is a different source for depth than in Area 3.												
134	Warning depth	Area 7	Meters	1	Fixed	New. Used by Depth of Water alert.	Command Input	No	N/A	Manual Input	As Required	As Required	Meters	0.1	CLASS	Nil	N/A	The Warning Depth would be entered by Command.
	Depth bracket	Area 7, Area 2																
	Potential threats / Type of threat and Safety/covertness reqs: Special/ atypical activities/ events	Area 7				We assume these alerts are based on contact or COI information determined elsewhere.												
135	Acknowledge alert	Area 7	N/A	Unk	Unk	New. When/if alert has been acknowledged, as suggested by Virtual VIC Data Model.	IID Control Input	No	N/A	Manual Input	As Required	As Required	N/A	N/A	UNCLASS	Nil	N/A	
136	End alert	Area 7	N/A	Unk	Unk	New. When/if alert has ended, as suggested by Virtual VIC Data Model.	IID Control Input	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	
137	List of COIs	Area 8	N/A	N/A	Unk	New. IID Design Doc tends to use "contact" and "COI" interchangeably, when in fact a "COI" is a particular type of contact we want to investigate. Therefore, we need a list to specify what COIs should be considered.	Command Input	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	
	Other contacts speed, course, bearing: Organize all contacts by domain	Area 8 - Contact Mgt, (Speed, Course, Bearing available elsewhere)				Uses other reports of Contact Speed, Course and Bearing. Could use reports from Sonar or SFCS. Assume this is just a sort/filter on info already provided to IID.												
	Track number	Area 8 - Contact Mgt, Area 3, Area 5-Brg Rate, Area 8-Weapons																
138	COI Classification/Uncertainty of COI classification: Show current state of classification	Area 8 - Contact Mgt	N/A	N/A	Unk	In what format is uncertainty in classification used in IID (confidence level, qualitative, discrete/continuous, etc.)?	Command Input	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	The classification confidence level are roughly determined: If classified visual + EW, Intercept or sonar (BB, LOFAR, DEMON), 100% (i.e. CERT) If classified visual only (range, weather, or time of day factors in), 85% (i.e. PROB) If classified sonar (BB) + EW or LOFAR, 75% (i.e. PROB) If classified sonar (BB) + intercept or DEMON, 60% (POSS) If classified sonar (BB) only, 40% (ie POSS).
	COI ~~identification~~ Allegiance, Category, Platform	Area 8 - Contact Mgt, Area 3, Area 4, Area 5-Rel Rng, Area 5-Rel Brg																
139	COI data: Show vitals on contact	Area 8 - Contact Mgt	N/A	N/A	Unk	Assume the vitals are measured values (e.g., from sound room).	Command Input	No	N/A	Manual Input - Remote Input from sound room	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	Information will be provided by Sound Room.

			Properties of Information for IID				Properties of Required IID Information in the Submarine System(s) in Which It Is Available											
No.	IID Info Definition	IID Display Ref (Area)	Units	Resolution	Allowed Staleness	Comment	Submarine System	Publish/ Subscribe Done	Transmission Format	Potential Method(s) to Transfer Info to IID	Time Between Data Refresh Within System	Update Rate of Info Sent From System	Units	Resolution	Security Designation	Constraints	Prioritization of Multiple Systems	Comment
140	Sensors holding contact	Area 8 - Contact Mgt	N/A	N/A	Unk	There will be a difference between sensors that are receiving data on the contact, which would be available only at the sensor level, and sensors that are reporting on the contact, i.e., sending cuts over to SFCS. The latter would be much easier to provide to IID, but there would be no way of knowing when SFCS is not receiving reports (e.g., sensor told to cease reporting) but the sensor still has contact.	Command Input	No	N/A	Manual Input - Remote Input from sound room	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	Information will be provided by Sound Room.
141	Integrated interpretation of COI counterdetection measures and ownship signature and Integrated and interpreted risks of safety, covertness, and mission progress associated with Tracking a COI: Show when ownship is in sensor range	Area 8 - Contact Mgt	N/A	Unk	Unk	"show when ownship is in sensor range" means when ownship is in range of contact's sensors. Seems to involve info types for range from OS to COI, counterdetection range. Not clear what exact display pops up, and what info is displayed (although likely to just involve existing info available to IID).	Command Input	No	N/A	Manual Input - Remote Input from sound room	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	Information will be provided by Sound Room.
	COI counterdetection ranges	Area 8 - Contact Mgt																
142	Integrated and interpreted risks of safety, covertness, and mission progress associated with Tracking a COI: Show when ownship is in weapons range	Area 8 - Contact Mgt	N/A	Unk	Unk	"ownship is in weapons range" means ownship is in range of contact's weapons, so COI weapons range info will also be needed here to determine when to show, as with Area 4, Area 5-Rel Rng, Area 5-Rel Brg, Area 5-Brg Rate, Area 8-COI. Will also need info type for range between OS and COI.	A Priori	No	N/A	Download Data into IID	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	This information would be entered into the IID from various reference materials.
143	COI INT: Show when intelligence available	Area 8 - Contact Mgt	N/A	N/A	Unk		Command Input	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	
144	COIs listed in mission documentation	Area 8 - COI, Area 5-Brg Rate	N/A	N/A	Unk		Command Input	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	
145	Mission documentation	Area 8 - COI	N/A	N/A	Unk	New. To generate the list of COIs information type in the preceding item, we will also need the acutal "mission documentation". Note that the COI list is covered in Area 8-Contact Mgt.	A Priori	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	
146	COI Boolean	Area 8 - COI	N/A	Unk	Unk	New. T/F setting as to whether contact is COI, as per Virtual VIC Data Model.	Command Input	No	N/A	Manual Input			N/A	N/A	UNCLASS	Nil	N/A	Determined by Command
	~~COI records and COI data: Detailed information on COI as an aid to classification.~~	Area 8 - COI, Area 8-Weapons				This has been supplanted by the "Notes" and "COI Details" info types added below, which were specified in the Virtual VIC Data Model.												
147	Notes		N/A	N/A	Unk	New. Any notes specific to the contact, as per Virtual VIC Data Model. Clarify whether these Notes are available for any contact, or only contact designated as COI.	A Priori	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	
148	COI Details		N/A	N/A	Unk	New. Details/records related to the COI, as per Virtual VIC Data Model.	A Priori	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	
149	COI records: Show all library data on a detected COI.	Area 8 - COI	N/A	N/A	Unk	Looks like this will draw on a variety of other established info types. Likely to be threat database and TOTE.	A Priori	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	
	COI counterdetection ranges:	Area 8 - COI, Area 4, Area 5-Rel Rng, Area 5-Rel Brg																
150	Integrated interpretation of COI counterdetection measures and ownship signature: Show when ownship is in counterdetection range of COI	Area 8 - COI	Unk	Unk	Unk	Will also need 'COI counterdetection ranges' [Area 4, Area 5-Rel Rng, Area 5-Rel Brg, Area 8-COI] to determine when to show. Not sure what info is displayed and the format of the display.	Command Input	No	N/A	Manual Input from Sound Rm	As Required	As Required	Unk	Unk	CLASS	Nil	N/A	
	COI weapons ranges and type of weapon	Area 8 - COI																
151	Implications of COI's weapons, weapon ranges, and assets : Show when in COI weapons range	Area 8 - COI	N/A	N/A	Unk	Will need Area 8 (COI weapons ranges) to determine when to display this. Not sure of the format of the display or the information to be presented in the display.	A Priori	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	
152	Weather : Cloud coverage	Area 8 - Weather	N/A	Scale 0 -10	Unk		Manual Data Collection	No	N/A	Manual Input	As Required	As Required	N/A	Unk	UNCLASS	Nil	N/A	
153	Weather : Wind force	Area 8 - Weather	Knots	1	Unk		Manual Data Collection	No	N/A	Manual Input	As Required	As Required	Unk	Unk	UNCLASS	Nil	N/A	
154	Weather : Wind direction	Area 8 - Weather	Degrees	1	Unk		Manual Data Collection	No	N/A	Manual Input	As Required	As Required	Degrees	1	UNCLASS	Nil	N/A	
155	Visibility	Area 8 - Weather	Kyds	1	Unk		Manual Data Collection	No	N/A	Manual Input	As Required	As Required	Yards	0.1	UNCLASS	Nil	N/A	
156	Visual sea state	Area 8 - Weather	Unk	N/A	Unk		Manual Data Collection	No	N/A	Manual Input	As Required	As Required	Unk	N/A	UNCLASS	Nil	N/A	
157	Sunrise/sunset : bearing	Area 8 - Weather	Degrees	1	Unk		Manual Data Collection	No	N/A	Manual Input	As Required	As Required	Degrees	1	UNCLASS	Nil	N/A	
158	Moon: bearing	Area 8 - Weather	Degrees	1	Unk		Manual Data Collection	No	N/A	Manual Input	As Required	As Required	Degrees	1	UNCLASS	Nil	N/A	
159	Moon: phase	Area 8 - Weather	N/A	Scale 0 - 10	Unk	New. Moon visibility (New through Full), as suggested by Virtual VIC Data Model, but not clear if used by IID.	Manual Data Collection	No	N/A	Manual Input	As Required	As Required	N/A	N/A	UNCLASS	Nil	N/A	
160	Moon: trend	Area 8 - Weather	N/A	Waxing/Waning	Unk	New. Whether moon is "waxing" or "waning", as suggested by Virtual VIC Data Model, but not clear if used by IID.	Manual Data Collection	No	N/A	Manual Input	As Required	As Required	N/A	N/A	UNCLASS	Nil	N/A	
161	Sunrise: incline	Area 8 - Weather	Degrees	1	Unk		Manual Data Collection	No	N/A	Manual Input	As Required	As Required	N/A	N/A	UNCLASS	Nil	N/A	
162	Morning/evening nautical twilight	Area 8 - Weather	Degrees	1	Unk		Manual Data Collection	No	N/A	Manual Input	As Required	As Required	Hour, Min, Sec	Seconds	UNCLASS	Nil	N/A	

			Properties of Information for IID				Properties of Required IID Information in the Submarine System(s) in Which It Is Available											
No.	IID Info Definition	IID Display Ref (Area)	Units	Resolution	Allowed Staleness	Comment	Submarine System	Publish/ Subscribe Done	Transmission Format	Potential Method(s) to Transfer Info to IID	Time Between Data Refresh Within System	Update Rate of Info Sent From System	Units	Resolution	Security Designation	Constraints	Prioritization of Multiple Systems	Comment
163	Time that information about the external environment was gathered	Area 8 - Weather	Seconds	1	Unk		Manual Data Collection	No	N/A	Manual Input	As Required	As Required	Hour, Min, Sec	Seconds	UNCLASS	Nil	N/A	
164	Weapon state: Tube Number	Area 8 - Weapons	N/A	Unk	Unk		CCS	No	N/A	CCS UNICAST - Set Weapon State Message	When New Data Received	When New Data Received	Tube Number	N/A	CLASS	Nil	N/A	The Weapon State:Tube Number is transmitted via UNICAST to a determined IP address. This data would be available in the Set Weapon State Message identified as "Tube" using a 32-bit unsigned integer.
165	Weapon state: Mode of weapon tube	Area 8 - Weapons	N/A	Unk	Unk		CCS	No	N/A	CCS UNICAST - Set Weapon State Message	When New Data Received	When New Data Received	N/A	N/A	CLASS	Nil	N/A	The Weapon State:Mode of Weapon is transmitted via UNICAST to a determined IP address. This data would be available in the Set Weapon State Message identified as "Exercise" using a 32-bit flag. The Value wouuld be represent either Normal or Exercise Modes.
166	Weapon state: Weapon type	Area 8 - Weapons	N/A	Unk	Unk		CCS	No	N/A	CCS UNICAST - Tube Inventory Message	When New Data Received	When New Data Received	N/A	N/A	CLASS	Nil	N/A	The Weapon State:Weapon Type is transmitted via UNICAST to a determined IP address. This data would be available in the Tube Inventory Message identified as "Weapon Type" using a 32-bit unsigned integer. The Value wouuld be represent Empty, MK48 Mod4 Warshot, MK48 Mod4 Exercise, Watershot, MK22, MK48 ModM Warshot, MK48 Mod4M Exercise, MK48 Mod7AT Warshot Simulator, MK48 Mod7AT Exercise Simulator, MK48 Mod7AT Warshot or MK48 Mod7AT Excercise.
167	Weapon state: Count	Area 8 - Weapons	N/A	Unk	Unk	Description implies inventory count of resources (MK 48, SSE, smoke candles, etc.) will be obtained from SFCS, but this information is not held by SFCS.	Manual Data Collection	No	N/A	Manual Input	As Required	As Required	N/A	N/A	CLASS	Nil	N/A	
	Weapon state: Track number	Area 8 - Weapons, Area 3, Area 5-Brg Rate, Area 8-Contact Mgt																
168	Weapon state: Target symbol	Area 8 - Weapons	N/A	Unk	Unk		CCS	No	N/A				N/A	N/A	CLASS	Nil	N/A	
169	Weapon state: Weapon enabling	Area 8 - Weapons	N/A	Unk	Unk		CCS	No	N/A	CCS UNICAST - MK48 Mod4 Telecom Message	0.25 Seconds	0.25 Seconds	N/A	N/A	CLASS	Nil	N/A	The Weapon state:Weapon enabling is transmitted via UNICAST to a determined IP address. This data would be available in the MK48 Mod4 Telcom Message identified as "Enabled" using a 32-bit flag. The Value wouuld be represent either True or False.
170	Weapon state: Weapon Under Control (WUC)	Area 8 - Weapons	N/A	Unk	Unk		CCS	No	N/A	CCS UNICAST - MK48 Mod4 Weapon Readback Message	0.25 Seconds	0.25 Seconds	N/A	N/A	CLASS	Nil	N/A	The Weapon state:Weapon Under Control is transmitted via UNICAST to a determined IP address. This data would be available in the MK48 Mod4 Weapon Readback Message. This message would provide all of the torpedo parameter information. This message will give all details such as Search Speed, Doppler Enable, Ping Interval, Target Mode, ASH, Trajectory Mode, Run Speed, Run to Enable, Search Depth, Ceiling and Acoustid Mode.
171	Weapon state: Status of bow caps	Area 8 - Weapons	N/A	Unk	Unk		CCS	No	N/A	CCS UNICAST - Tube Status Message	When New Data Received	When New Data Received	N/A	N/A	CLASS	Nil	N/A	The Weapon state:Bow Caps is transmitted via UNICAST to a determined IP address. This data would be available in the Tube Status Message identified as "Bowcap State" using a 16-bit unsiged integer. The Value wouuld be represent either Open or Shut.
172	Weapon state: Status of bow shutters	Area 8 - Weapons	N/A	Unk	Unk	This information type is missing from Design doc.	CCS	No	N/A	CCS UNICAST - Tube Status Message	When New Data Received	When New Data Received	N/A	N/A	CLASS	Nil	N/A	The Weapon state:Bow Shutters is transmitted via UNICAST to a determined IP address. This data would be available in the Tube Status Message identified as "Shutter State" using a 16-bit unsiged integer. The Value wouuld be represent either Open or Shut.
173	Weapon state: Submerged signal ejector (SSE)	Area 8 - Weapons	N/A	Unk	Unk		Manual Data Collection	No	N/A	Manual Input	As Required	As Required	N/A	N/A	UNCLASS	Nil	N/A	
174	Weapon state: Mode of SSE	Area 8 - Weapons	N/A	Unk	Unk	IID Design Doc Indicated as derived from SFCS? No current capability to get this info from SFCS.	Manual Data Collection	No	N/A	Manual Input	As Required	As Required	N/A	N/A	UNCLASS	Nil	N/A	
175	Weapon state: Type of item loaded in SSE	Area 8 - Weapons	N/A	Unk	Unk		Command Input	No	N/A	Manual Input	As Required	As Required	N/A	N/A	UNCLASS	Nil	N/A	Determined by Command
176	Weapon state: Torpedo limits display (TLD)	Area 8 - Weapons	N/A	Unk	Unk		CCS	No	N/A	CCS UNICAST - MK48 Mod4 Weapon Readback Message	0.25 Seconds	0.25 Seconds	Multiple: Meters, Yards, Knots	1 to 0.1	CLASS	Nil	N/A	The Weapon state:Torpedo Limits Display is transmitted via UNICAST to a determined IP address. This data would be available in the MK48 Mod4 Weapon Readback Message. This message would provide all of the torpedo parameter information. This message will give all details such as Search Speed, Doppler Enable, Ping Interval, Target Mode, ASH, Trajectory Mode, Run Speed, Run to Enable, Search Depth, Ceiling and Acoustid Mode.
	COI true bearing	Area 8 - Weapons																
	COI current course	Area 8 - Weapons, Area 5-Brg Rate																
177	Uncertainty of course of COI	Area 8 - Weapons	Degrees	0.1	Unk		CCS	No	N/A	CCS UNICAST - Threat Message		Minute	Radians	0.001	CLASS	Nil	N/A	The Uncertainty of course of COI is transmitted via UNICAST to a determined IP address.. This data would be available in the Threat Message identified as "Course Error" using a 32-bit floating point number.
	COI Speed	Area 8 - Weapons, Area 5-Brg Rate																
	COI Range Estimate	Area 8 - Weapons, Area 5-Rel Rng, Area 5-Rel Brg																

	Properties of Information for IID						Properties of Required IID Information in the Submarine System(s) in Which It Is Available												
No.	IID Info Definition	IID Display Ref (Area)	Units	Resolution	Allowed Staleness	Comment	Submarine System	Publish/ Subscribe Done	Transmission Format	Potential Method(s) to Transfer Info to IID	Time Between Data Refresh Within System	Update Rate of Info Sent From System	Units	Resolution	Security Designation	Constraints	Prioritization of Multiple Systems	Comment
178	Weapons state: Weapon details and target details	Area 8 - Weapons	N/A	Unk	Unk		CCS	No	N/A	CCS UNICAST - MK48 Mod4 Weapon Readback Message	0.25 Seconds	0.25 Seconds	N/A	N/A	CLASS	Nil	N/A	See Item #170.
179	Time that information about contacts was gathered	Area 8 - Weapons	Seconds	1	Unk		CCS	No	N/A	CCS UNICAST - Threat Message	Minute	Minute	Seconds	0.001	CLASS	Nil	N/A	The Time that information about contacts was gathered via UNICAST to a determined IP address.. This data would be available in the Threat Message identified as "Last Update" using a 64-bit double floating point number. This is the system time in seconds when this solution was last updated.
180	Scroll bar	Area 8 - Weapons	N/A	N/A	Unk	No external data required.									UNCLASS	Nil	N/A	
	COI Records	Area 8 - Weapons, Area 8-COI																
181	Watchlist Boolean	Area 8	N/A	N/A	Unk	New. T/F setting as to whether contact is a Watchlist entity, as per Virtual VIC Data Model.	IID Control Input	No	N/A	IID Design Dependant	N/A	N/A	N/A	N/A	UNCLASS	Nil	N/A	Does not require information from submarine system.
182	Watchlist information	Area 8	N/A	N/A	Unk	New. Specify the information to be displayed in watchlist, as per Virtual VIC Data Model. IID Design Doc doesn't provide details.	IID Data	No	N/A	IID Design Dependant	n/A	N/A	N/A	N/A	UNCLASS	Nil	N/A	Does not require information from submarine system.
183	Automatic Identification System (AIS)	Area 4	Decimal Degrees	0.0001	Unk		AIS	No	N/A	Automatic Identification System (AIS)	2 - 10 Seconds	2 - 10 Seconds	Decimal Degrees	0.0001	UNCLASS	Nil	N/A	The AIS can receive vessel Maritime Service Identitiy, Navigation Status (ie. At anchor), Speed over ground, Positional Accuracy, Course Over Ground, True Heading, True bearing at own position and UTC Seconds (time when data sent). In addition, the ship identification number, Radio Call Sign, Name of Vessel, Type of Ship, Dimensions of ship, Location of GPS onboard, Type of GPS, Draught of Ship, Destination and ETA.

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List of symbols/abbreviations/acronyms/initialisms

A-D	Analog to Digital
AIS	Automatic Identification System
BSS	Bathymetric Sampling System
C&PO	Chief and Petty Officer
CCS	Command and Control System
CFB	Canadian Forces Base
CO	Carbon Monoxide
CO	Commanding Officer
CO2	Carbon Dioxide
COI	Contact of Interest
CS	Combat System
CSS	Central Surveillance System
CWA	Cognitive Work Analysis
DGS	Data Gathering System
DND	Department of National Defence
DRDC	Defence Research & Development Canada
EC	Engineering Change
ECPINS	Electronic Chart Precision Integrated Navigation System
ESM	Electronic Support Measures
ETA	Estimated Time of Arrival
FY	Fiscal Year
GFI	Government Furnished Information
GPS	Global Positioning System
IID	Information Integration Display
INS	Inertial Navigation System
IP	Internet Protocol
LAN	Local Area Network
LMC	Lockheed Martin Canada
N/A	Not Applicable

Nav O	Navigation Officer
O2	Oxygen
Op O	Operations Officer
OSN	Ownship Noise
R&D	Research & Development
SDM	SHINNADS Dual Monitor
SHINNADS	Shipboard Integration Navigation and Display System
SV	Sound Velocity
TWS	Tactical Weapon System [Trainer]
Unk	Unknown
VCS	Victoria Class Submarine
w.r.t.	With Respect To